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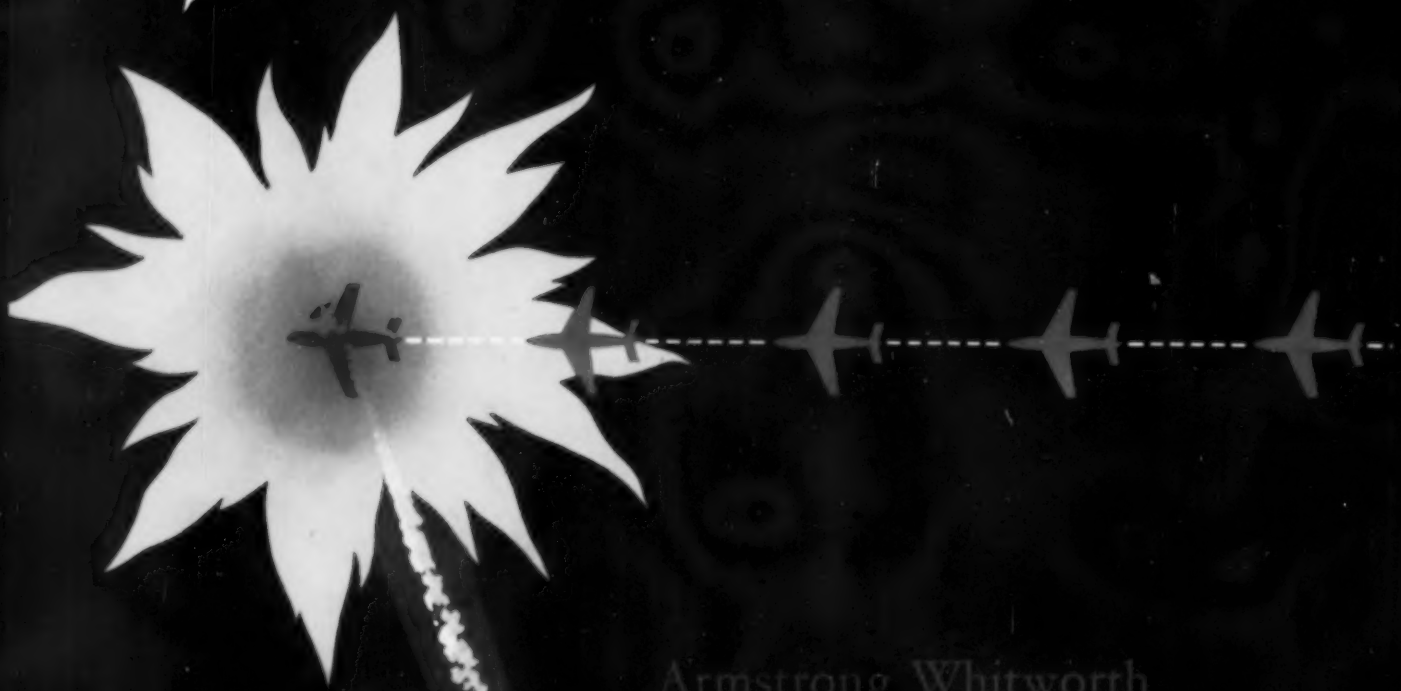

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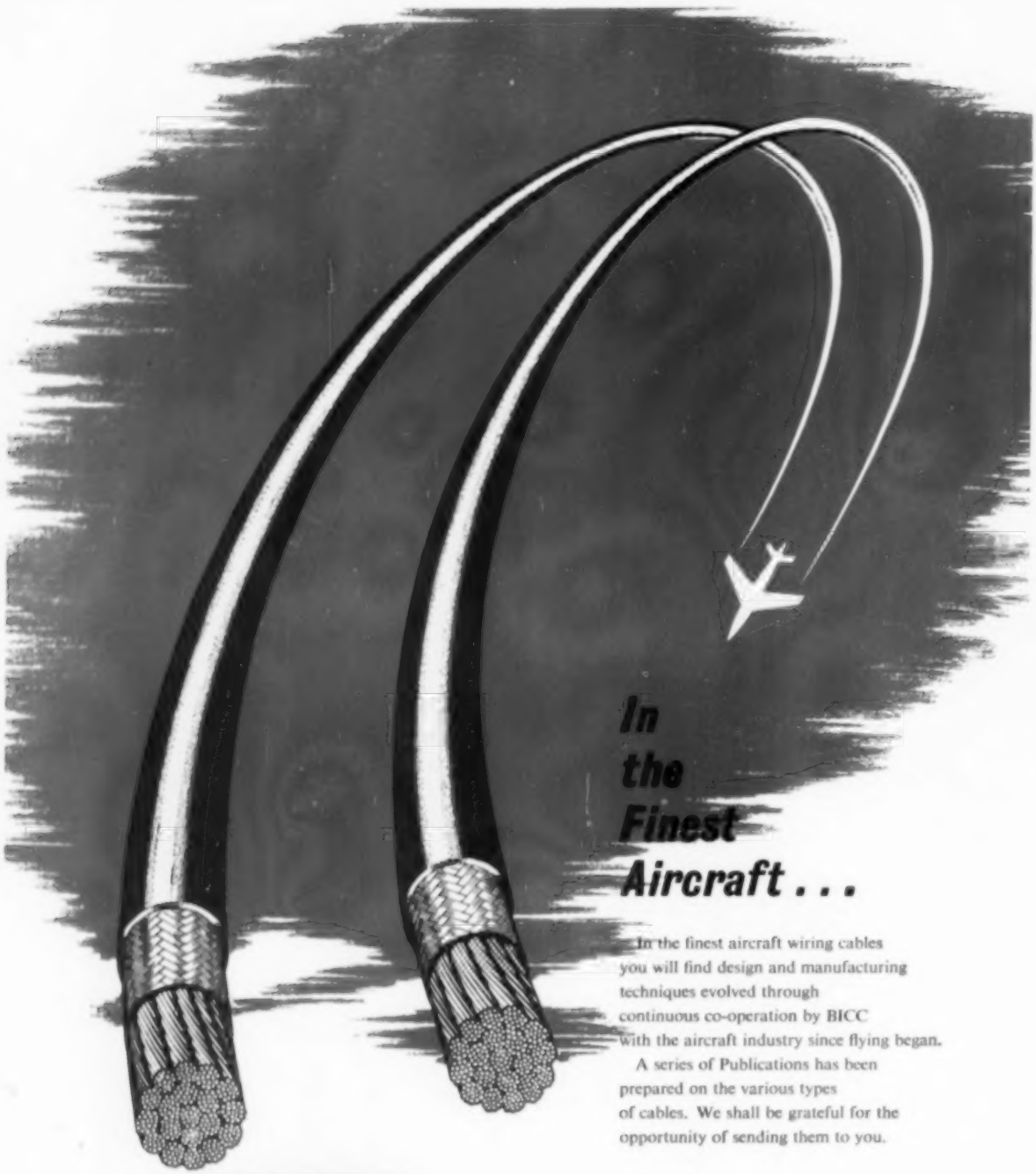

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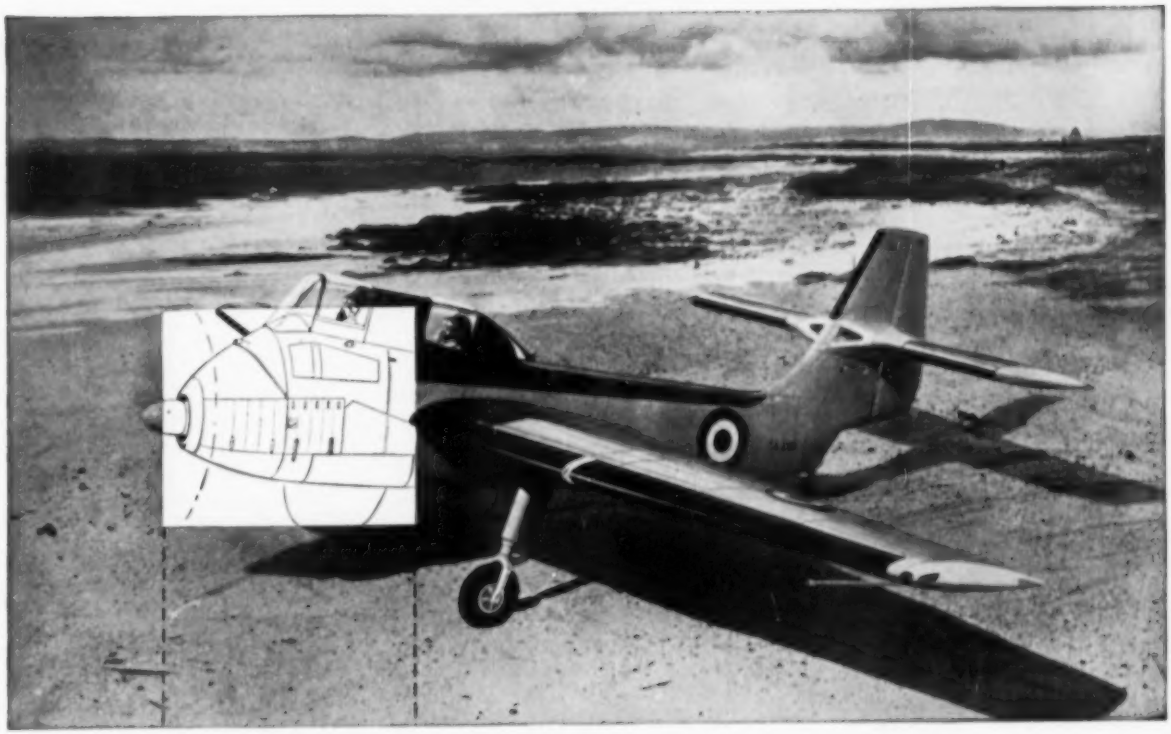

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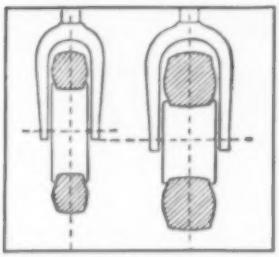

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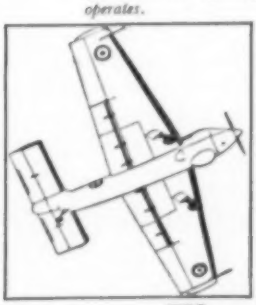

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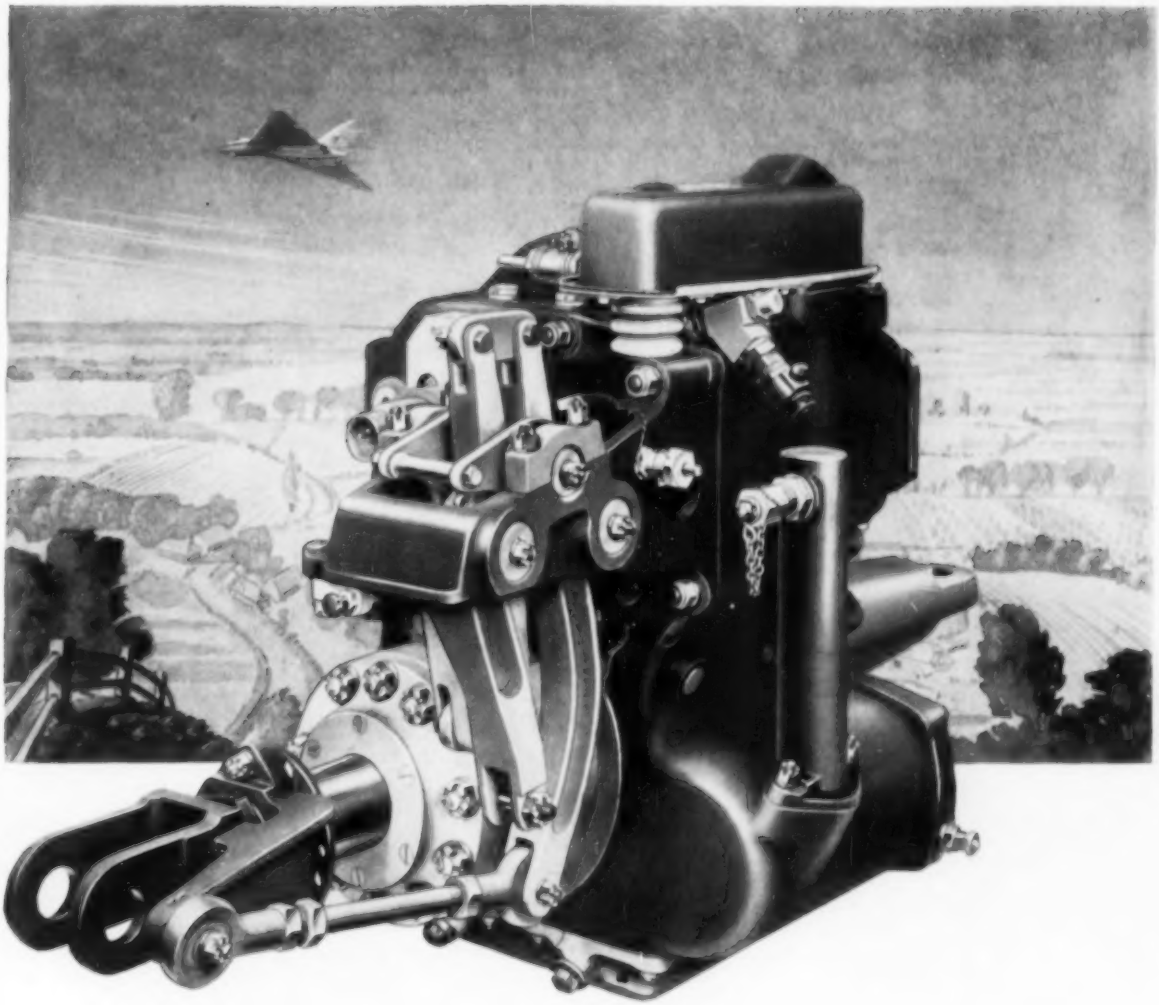

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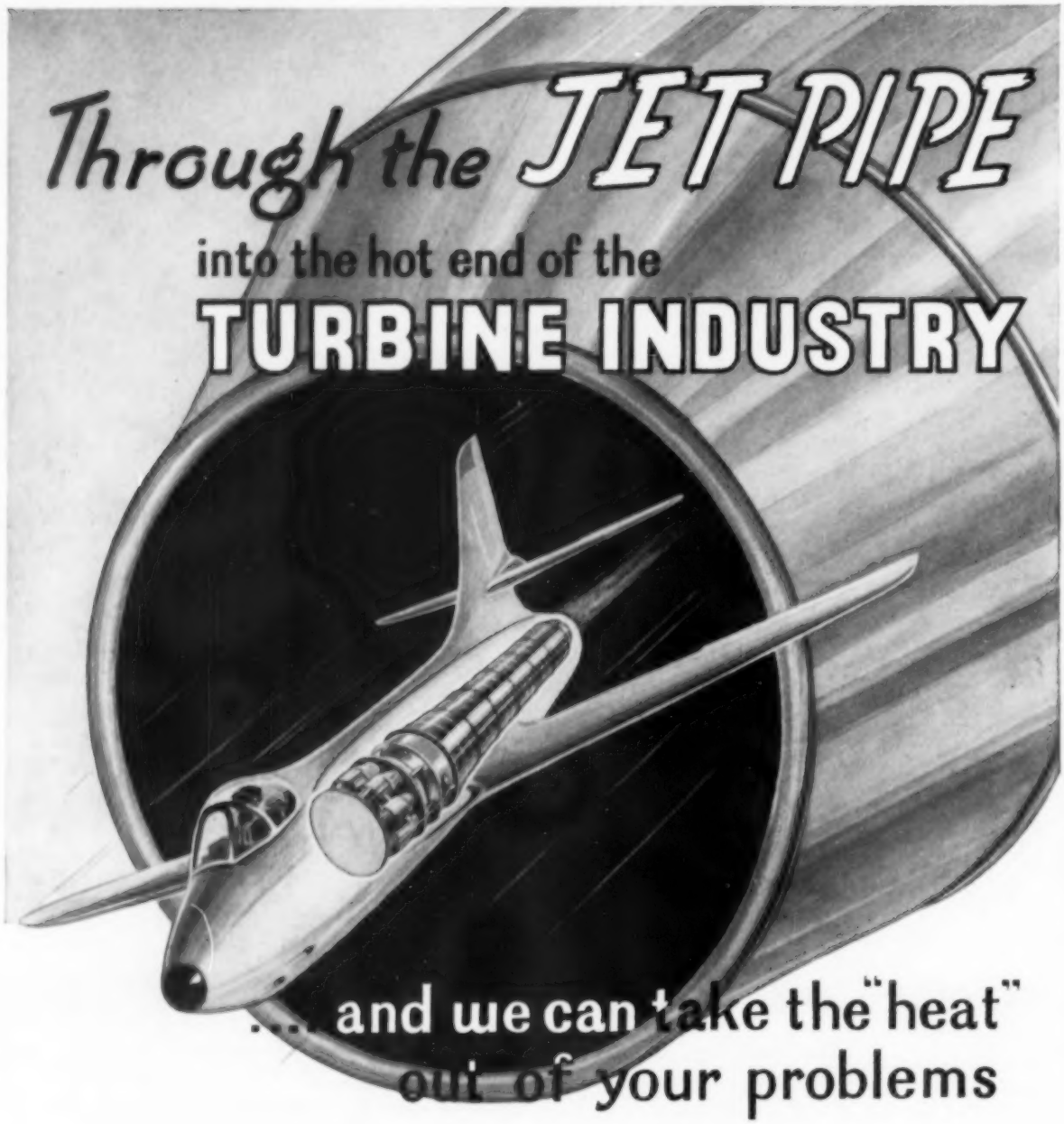

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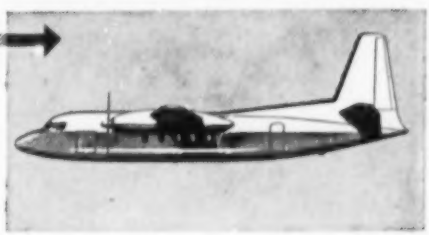

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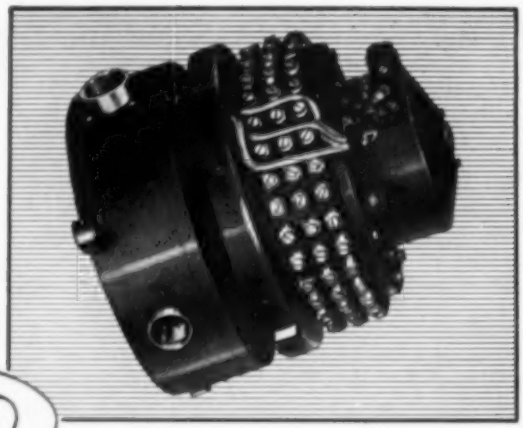

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Acceleration	**To BSS G. 100**
Weight	**13½ lbs.**
Connections	**From intervalometer—5 pin climatic proof breeze plug. From A.C. supply—4-pin climatic proof breeze plug.**
Voltage	**Operating—24 volts D.C. (nominal). Load 4.5 k.V.A. at 208 volts, 400 cycle, three phase A.C.**
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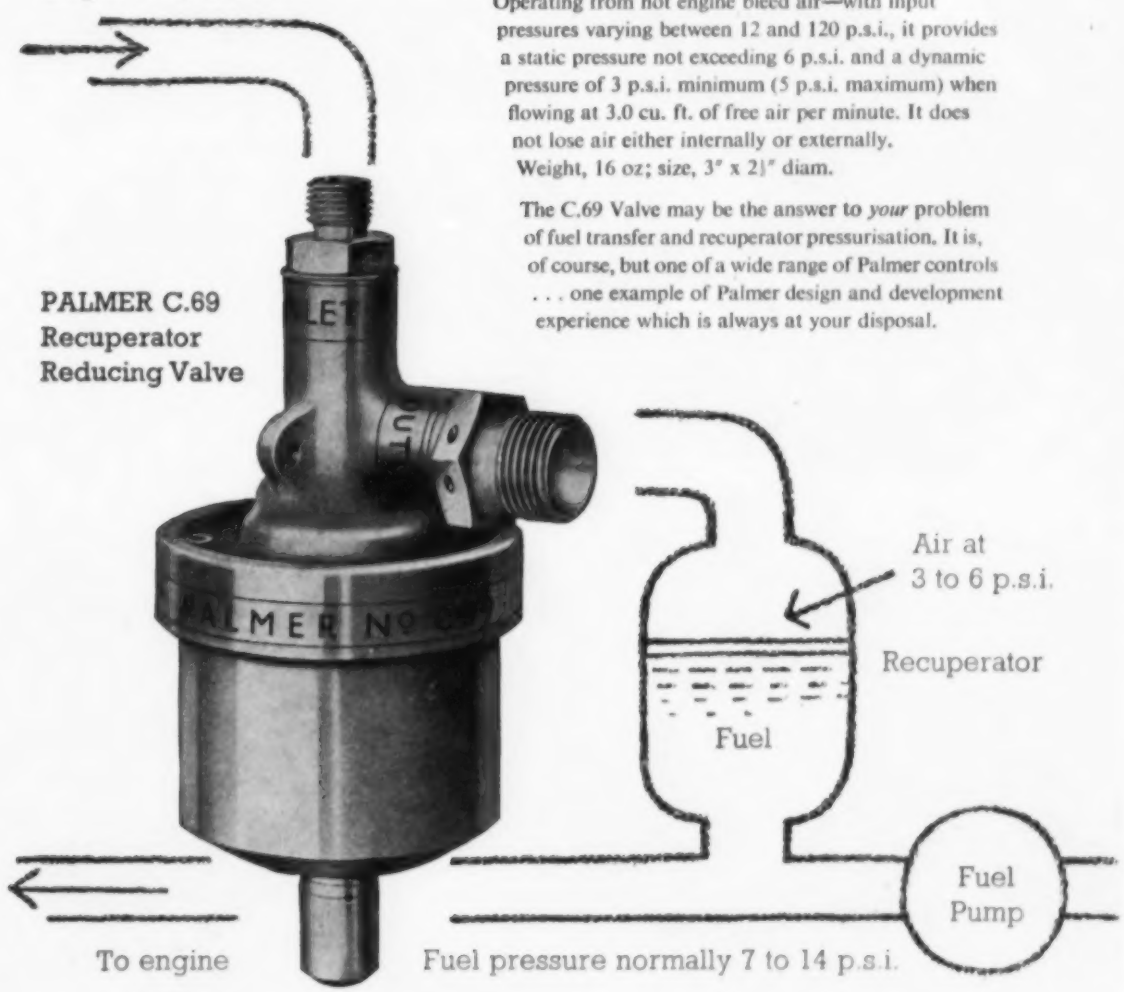

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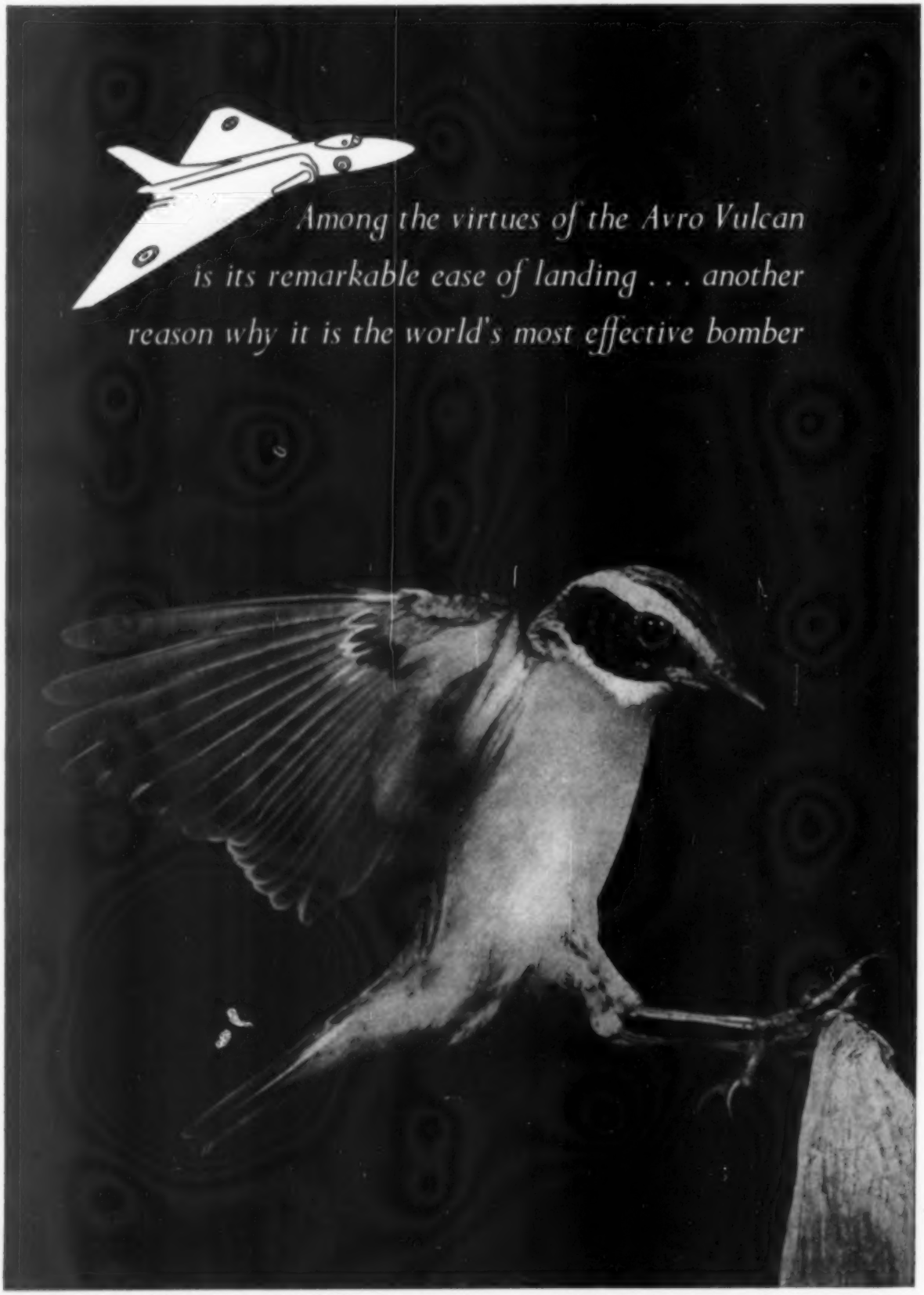
Among the virtues of the Avro Vulcan
is its remarkable ease of landing . . . another
reason why it is the world's most effective bomber

Leah Windchat photographed by Eric Hosking. Taken by high-speed flash with a specially constructed set giving 680 joules with two lamps at an exposure of 1/5,000th second at f/45

FLIGHT
and
AIRCRAFT ENGINEER

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Founded 1909

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New Comets . . .

"TWENTY Comets for B.O.A.C.," read the headlines last week, and the great majority of people must have registered the bare content of the statement but no more. In view of the frequency of announcements about B.O.A.C.'s various airliners in operation, ordered or subject to negotiation, it is not surprising if the public, who already know that the way for the Comet's future has been cleared, find no special significance in this latest order. Yet it means that the Comet 4 is on the way, and that Great Britain can again hope to take the lead with the most modern of jet airliners. The clarification of plans for future Comets is of world-wide as well as direct national importance, and the way in which these plans are working out seems to us to be the most satisfactory one possible in the circumstances.

No constructor likes to have large numbers of different aircraft in his shops at any one time. One variant is bound to hinder the next, and it is an uneconomical way to work. The introduction of most new models is, in general, delayed by the necessity to continue with predecessors and to see them through to the end of their development lives. This is more or less inevitable in the normal course of progress, but out of de Havillands' and the Comet's erstwhile troubles has arisen a different possibility, transformed into actuality by the B.O.A.C. order. As a result, the manufacturers can now concentrate their efforts on the latest and by far the most useful model of Comet so far.

In spite of the interruption of airline services, development of Comets has been continuous from the start; a great deal of operating experience has been obtained; and it has been possible to build, fly and profit from a Mk 2 and 3, and then to leap ahead of stage three. The resulting Mk 4, with greatly increased power provided by Rolls-Royce Avon RA.29s, and incorporating all the latest airframe developments, can be built for B.O.A.C., with deliveries starting in 1958. At this time the machine will be ahead of any competitor and the "climate" will, without doubt, have improved for jet airliners. Preliminary details of the B.O.A.C. order appear on page 374.

In the meantime, the existing Comet 2s and those largely completed (four have flown of a total of about twenty) will be modified—in fact, work has already started. They will not require re-skinning but will be stiffened, provided with a new shape of window and otherwise modified in the light of the mass of information now available. The type will be submitted for full C. of A., and then used by R.A.F. Transport Command for freight and passenger work. The R.A.F. may have as many as twelve.

One of the existing machines—according to present plans—will also be fitted with Avon powerplants similar to those specified for the Comet 4, and with its aid B.O.A.C. expect to prepare the way for operation of the Mk 4, thus saving both time and expense when deliveries are made. This sensible course might well be adopted by other operators who may be considering placing orders for the latest Comets.

With its rather earlier and lower-powered Avons the medium-stage Comet 2, as modified for the R.A.F., will also be available for airline use; but with the 4 in prospect in a relatively short time, and bearing in mind the re-equipment programmes on which the world's major airlines have already embarked, it does not seem likely that many 2s will be used in this way.

. . . and Heralds

Another encouraging event of last week, also with a special significance, was the flight of the Alvis Leonides Major engine in its Handley Page (Reading) test-bed. Details and photographs will be found on pages 376 and 393. The steady progress with the Handley Page Herald H.P.R.3 prototype, for which these engines are destined, and the very promising early results of sales activities for this feederliner, give good reason to hope that the country will have here another winner.

There is a feature in its development programme which is held in common with B.O.A.C.'s RA.29 Comet 2. The two Leonides Majors of the H.P.R.5 test-bed, forward of the bulkhead, are identical with the inboard units for the Herald. Thus, in this instance also engine-flying hours will be built up rapidly, early operating experience will be gained, and some time will no doubt be saved on the final product.

FROM ALL QUARTERS

El Al Wants Britannias

FOREIGN operators' interest in the Bristol Britannia received concrete expression on March 18th, when the manufacturers issued the following statement:—

"Mr. L. A. Pincus, managing director of El Al Israel Airlines, has today intimated to the Bristol Aeroplane Company El Al's decision to acquire three Bristol Britannia Mk 300 L.R. airliners, and has asked for an option on a further two. Detailed contract negotiations are in progress and are expected to be completed in the near future."

Comet 4s for B.O.A.C. and—

ALTHOUGH it is still only a matter of weeks since the Comet Inquiry Report was published, it has been possible for de Havillands and B.O.A.C. to discuss outstanding commitments and new Comet requirements, and the outcome is an order by B.O.A.C.—presumably supplanting existing orders—for 20 of a new mark of Comet to be known as the Mk 4. The importance of this decision and the clarification of future planning which it brings are the subject of comment in our leading article.

The official joint statement, made on March 16th, announces that "the 20 Comets that B.O.A.C. will buy from de Havillands are to be of an entirely new type—a Mk 4 Comet fitted with RA.29 Rolls-Royce engines. The arrangement is approved by the Government and clarifies the forward manufacturing programme of the de Havilland company. The Mk 4 includes all the experience gained in operating the Mk 1 Comets. It also incorporates structural design improvements which are the outcome of the research investigations done at Farnborough, and the findings of Lord Cohen's Court of Inquiry."

With the exception of the pinion fuel tanks, which will be of larger size, the Comet 4 will be outwardly the same as the Comet 3 now flying. It will be recalled that the Comet 3 first flew in July of 1954, and since then the performance, aerodynamic and handling qualities have been largely established. Much of this information will in due course apply directly to the Comet 4.

RA.29 Avons will bestow on the 4 a much improved performance. These latest axial units have a specific consumption 9 per cent better than for the earlier mark, and each is stated to produce "a 500-lb increase in take-off thrust". This is taken to mean that the maximum output is approximately 10,500 lb, the RA.26 having been mentioned as a 10,000-lb unit.

The Comet 4 for B.O.A.C. is to accommodate 58 passengers for a stage-length of 2,870 miles, against a 50-m.p.h. headwind. B.O.A.C. have indicated that a London to Johannesburg flight would require stops only at Cairo and Nairobi (or Entebbe). For North Atlantic operation, one stop would have to be made, at Gander. Cruising speed is expected to be slightly higher than for earlier Comets, namely, and in round figures, 500 m.p.h. No reference has been made as yet to operating heights, but presumably these will again be in the region of 40,000ft.

In preparation for their Comet 4s, B.O.A.C. are also negotiating for delivery as quickly as possible of one of the existing Comet 2s specially equipped with RA.29 Avons. This would enable engine hours to be built up, operating techniques to be worked out, and crew training to be undertaken well in advance of Comet 4 deliveries—due to begin in 1958.

—the Future of Comet 2s

SOME 20 Comet 2s are in existence, or nearing completion, mainly at Hatfield, but also at Chester and Belfast. They have an early mark of Avon, in the 500 series (related to the military RA.7), giving some 7,350 lb thrust. The figure of the specific consumption, first announced as 0.89 lb/hr/lb, may have been further improved as a result of developments by the time the aircraft come into service.

To enable them to qualify for a full passenger C. of A., certain modifications need to be carried out to the airframe, but total re-skinning is not called for. A complete new water-tank test will be carried out with the modified airframe.

De Havillands will still offer a number of Comet 2s for medium-stage airline operations, and work has already started on the modification of existing machines. The Royal Air Force have earmarked an undisclosed number (six was the figure mentioned at one stage) of Comet 2s for Transport Command and, coming into operation as they will in less than two years, they may be regarded as a real windfall for a branch of the Service that has been much neglected in the matter of equipment. They will be particularly useful in reducing travel time between the U.K. and Woomera Range.

In their statement, both B.O.A.C. and de Havillands make a point of warmly acknowledging Government help over their decisions and negotiations.

American Otters

SINCE the paragraph on p. 385 went to press it has been learned that the 90 de Havilland Canada Otters for the U.S. Army will, in fact, be designated de Havilland U-1. On March 14th the official handing-over ceremony for the first half-dozen U-1s took place at the company's new plant at Downsview, Ont., at which 25 U.S. Army officers and 600 Canadian and American Government and business guests were present. After a short speech by Mr. Phillip C. Garratt, D.H.C. managing director, the ceremonies were completed by the handing-over of log-books by Mr. Russ Bannock, Director of Military Sales, to Maj-Gen. Louis W. Prentiss, Commanding General of the Engineer Centre, Fort Belvoir, Va.

The first batch of U-1s, six of which are seen below, are painted in Arctic colours (white with red wing-tips and tail) and will be used as supply aircraft on topographic survey operations in Alaska and the Caribbean. Subsequent U-1s will be used by the Transportation Corps Troop Companies for a multitude of tasks.

De Havilland Canada have now delivered 80-odd Otters, the list of purchasers including the R.C.A.F., Royal Norwegian Air Force, Canadian Pacific Air Lines and Philippine Air Lines.

Bristol-Johannesburg Impressions

LAST week we gave the condensed log of the Mk 100 Britannia G-ANBA for its flight from Bristol to Johannesburg, where it was to begin a month of tropical trials. The 6,063 statute miles, with a refuelling stop at Khartoum, were covered in an elapsed time of 18 hr 52 min; flying time was 17 hr 24 min, representing a ground speed of 348 m.p.h.

The following are extracts from an account of the flight written by one of the 42 officials and technicians on board, Mr. C. B. Bailey-Watson, the company's public relations manager:—

"We took off at the 150,000-lb gross weight of the Mk 100 and, climbing fast on course for Malta, crossed the English coast 18,000ft over Lymington ten minutes later. At 20,000ft W/C. Gibb . . . levelled off for the pre-computed flight plan of *en route* steps of 1,000ft every hour. Cruising at 352 m.p.h. T.A.S. we crossed Le Havre at 1255 with a beam wind of 25 kt. The greater part of France along our track was hidden by a layer of ¼ strato-cumulus, but this later dispersed to show the grandeur of the snow-clothed Alpes Maritimes shining in the sun. . . .

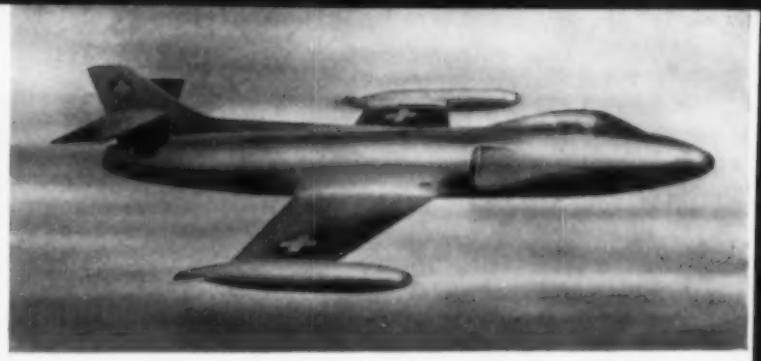
"Malta was passed at about half-past four, 25,000ft beneath us; the Britannia's true airspeed was now . . . 357 m.p.h. in a strengthening starboard-bow wind of 46 kt. This was the presage of a jet stream which we met on crossing the African coast. The navigator plotted it as 165 m.p.h. from 260 deg but as we flew on it gradually moved round more northerly and so gave us a helpful component.

"At 2041 we started let-down from 26,000ft about 80 miles distant from Khartoum; leaving the jet stream behind and above us, we dropped at a steady 190 kt I.A.S. and touched down on runway 36 at six minutes past nine—six minutes past eleven local time. The thermometer in the aircraft cabin was registering a very comfortable 75 deg, but as we stepped out . . . a breath of soft air at 80 deg felt very different from the knifing chill of the breeze we had left only so few hours away in England. . . .

"Shell was rapidly off the mark in connecting up the bowsers; and at about a quarter past ten we once more climbed into the

ARMY RED-TABS: Finished in white, with red tails and wing-tips to stand out against snow, D.H.C. Otters for the U.S. Army—90 have been ordered—have a particularly smart appearance on parade. The official handing-over ceremony of the first batch is reported above.

BOMBER KILLER: Referred to in an item on this page is the 100 lb, six-foot-long Hughes Falcon air-to-air missile. Its solid-propellant rocket gives 6,000 lb of thrust, and launching acceleration is some 60 g. Up to six Falcons will arm the Convair F-102A.



FOR ALPINE ASSAULT: Two prototypes of the P.16 attack aircraft, shown in this artist's impression, should be completed in Switzerland in a few weeks. Designed to minimize that country's topographical handicaps, it should have an unusually good short-field performance.

aircraft, engines were started at 2223, chocks away at 2227 and at 2234 we were airborne. Two minutes later we were climbing on course at 780 ft/min to level out at 19,500ft at 2301 hr, and thence settle down to a cruising speed of 342 m.p.h. T.A.S. with the benefit of a quartering wind, albeit of only 12 kt.

"Behind us an upside-down Great Bear pointed to a dim Polaris low on the northern horizon whilst in the eastern sky a larger, brighter moon than we see in England climbed steadily to its zenith.

"Nearing the equator the inter-tropical front piled the clouds into great thunderheads, and all round the horizon lightning flashed in brilliant cloud-shot explosions. Walter Gibb lifted the aircraft to 22,000 to avoid the turbulence and we had a smooth enough ride, the four Proteus purring softly with an even, muted roar quite unlike the harsher beat of piston engines.

"As dawn loomed on the eastern horizon at 0330 hr we passed over the southern end of Lake Tanganyika, flying at a constant 22,000ft and our 355 m.p.h. true airspeed helped by a 20 kt wind very nearly behind us.

"At ten to five of a bright morning we crossed the chocolate-coloured Zambesi some 200 miles to the N.E. of Livingstone; airspeed now 363 m.p.h. true and ground speed not much better than 340 as we were flying into a 20 kt headwind. At 0547 we passed 22,000ft over Bulawayo and a little over half an hour later were talking to Johannesburg control. Let-down was started at 0620 about 90 miles from Jan Smuts and, finding it a little difficult to identify because of the haze, we passed over the field at 0702, to land exactly five minutes later. . . .

"We stepped out to be greeted by a cheer from the thousands of people who had come to welcome us."

American Missiles—Official

ALTHOUGH a fair amount of information concerning American missiles has been forthcoming over the past few years, comparatively little of this has emanated from official sources. It is, therefore, appropriate to place on record the gist of a recent statement by Mr. Trevor Gardner, U.S. Assistant Secretary for Air, dealing with some of the latest of these weapons.

Falcon is confirmed by Mr. Gardner as being an air-to-air missile having "a brain of its own" (this presumably means active homing). It is 6ft long, weighs 100 lb, and is in production at a U.S.A.F. plant operated by the Hughes Aircraft Company, in Tucson, Arizona. It will be carried "in large numbers" by all-weather intercepters, and its explosive war-head makes "virtually every hit a sure kill".

One of the greatest development programmes ever undertaken in America is that of Atlas SM-65, a two-stage intercontinental ballistic missile. The reduction in size of H-bomb packages has considerably lowered the all-up weight, but the first stage still requires a rocket (made by North American) of 120,000 lb thrust. The trajectory for a 5,000-mile range rises to a height of 800 miles; the speed at burnout has to be 22,000ft/sec.

Transport Turboprops

BRITAIN'S fine new turboprops, the Bristol BE.25 and Rolls-Royce RB.109, have so far been kept "under wraps" because, although both are primarily civil engines, they incorporate developments to be found in our latest military turbojets. However, in order that commercial discussion of these engines may be facilitated, their security status has been eased this week. Paradoxically, neither engine may yet be described in detail owing to the fact that, in a keenly competitive sphere, the manufacturers are reluctant to reveal such details publicly.

The BE.25 is a "two-spool" high-compression engine, built largely of steel and giving a power which remains constant at roughly 4,000 s.h.p. (about 5,750 e.h.p.) at all altitudes, temperatures and humidities which could be experienced during take-off. At altitude the engine can be "opened up" to give a very high cruising output. Owing to its high pressure-ratio and excellent component efficiencies (which have been realized during component testing) the BE.25 promises to be one of the most efficient aero engines yet built, with an s.f.c. of about 0.385 lb/hr/e.h.p.

The RB.109 is a considerably smaller axial engine with almost as much take-off power but a lower cruising rating. It is expected to have about twice the weight and mass-flow of the Dart, considerably more than twice the power (4,020 rated s.h.p.) and roughly the same installed diameter. Neither the RB.109 nor BE.25 has yet run as a unit, but both are expected to run this year.

The Napier company are also known to have an up-rated Eland, designated E.153 or NEL4, which is in roughly the same power class as the engines above (3,765 s.h.p.). Although of earlier conception than its competitors this Eland is almost certainly much nearer the flight stage and it may be ready for commercial use upwards of a year earlier. This engine is basically the same as the Eland described in *Flight* of July 23rd, 1954. All three of the new engines were described in our issue of January 28th, 1955.

Sports Jet

ANYONE who happened to be at Woodley airfield, Reading, last mid-week, might have had a first look at the small, butterfly-tailed jet racer, the SK-1, which is nearing completion there. Hugh Kendall, with his small team, is building the aircraft to his own design for Nat Somers—a company, Somers-Kendall Aircraft, Ltd., having been formed for the purpose.

To test the landing gear, comprising a central Gemini main-wheel used as such, a Gemini tailwheel now fitted as a steerable nosewheel, and tiny outriggers at the wing-tips, all of which equipment is retractable, the aircraft was towed behind a Land Rover. Up to the 50 m.p.h. maximum attained, Mr. Somers found everything to be functioning well, and he was also able to try the flying controls, which were just beginning to come in satisfactorily. The 330-lb-thrust Palas has next to be installed and the machine is due to fly, possibly from Boscombe Down, in the summer.

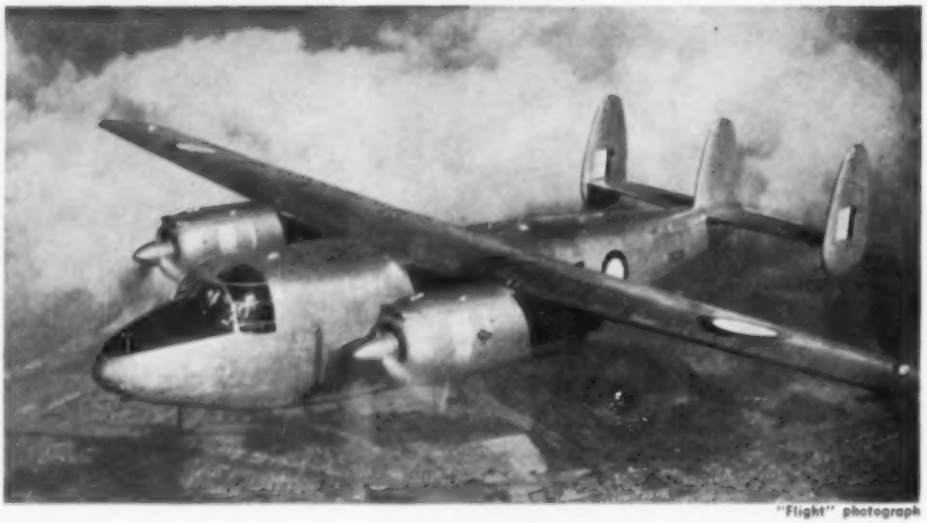
Avros Then and Now

EVEN more successful than its predecessors was the fourth annual reunion dinner of the Avro 504 Club, which took place at Londonderry House, London, last Friday. Sir Roy Dobson was unfortunately unable to get back from Canada in time to attend, but his place was taken by Mr. C. E. Fielding, Avro's works director, who replied to A. Cdre. John Oliver's toast to the company. Sir William Farren was also present. In his speech to the veterans and the new apprentices Mr. Fielding said that old methods would not do any more and, for example, use was now being made of the Manchester digital computor, of which Avros had been the first purchaser. With its aid, more cases could be investigated, and there were fewer unknowns. There was no need to feed an "ignorance factor" into the calculator. In addition, a Mach 1.5 wind tunnel was nearly ready and a Mach 3 tunnel was being built. Honeycomb sandwich construction was under development and parts were being used, and the problem of double curvature had now been mainly overcome.

The toast of the guests was proposed by Mr. J. C. C. Taylor, who has been largely responsible for the formation and activities of the 504 Club, although the hard work in the background of Mr. Philip Kidson, of Avros, is freely acknowledged. A. Cdre. A. H. Wheeler, A.O.C. Boscombe Down, replying for the guests, talked of the formation of the Shuttleworth Collection and the care of its veteran aircraft. He spoke of the 504 which Avros were now helping to renovate and he appealed to anyone who might be able to help with 504 spares. A search is also being made for a Wolseley Viper for the Collection's S.E.5.

Sir Alliott Verdon Roe then presented the 504 Club trophy to Mr. R. A. Gellatly, B.Sc., the third apprentice to win the award.

FROM ALL QUARTERS...



"Flight" photograph

***FOURTEENS UP:** An attractive aircraft in its own right, the H.P.R.5, which first flew last week (see below), is in fact intended only as a flying test-bed for Alvis Leonides Major engines. The aircraft, previously the Mamba-Marathon, will be flying on a Ministry of Supply development programme. The nacelles are largely identical with the inboard units for the Herald.*

Leonides Majors Airborne

IN view of its importance to the success of the Handley Page Herald feederliner and the requirement for helicopter applications, the Alvis Leonides Major engine is now entering a stage of intensive development. Two events of considerable importance have recently occurred. Last week the H.P.R.5 flying test-bed took off for the first time, and subsequently, without delay or trouble, continued with a number of hours of handling. (Photographs appear above and on page 393.) The second event was the successful completion at the first attempt of a 150-hr simulated type test. With these two important hurdles crossed the Leonides Major is well set to face the type test proper and to build up the considerable amount of air experience which necessarily precedes airline service.

Were the Major a completely new design doubts as to its chances of being ready and available in time might be considerable; but in fact the majority of main units, especially the moving ones, are employed in common with the Leonides "9" —or Minor, as it is now referred to colloquially for clarity. In addition it may be recalled that the original design from which the Leonides was developed was itself a 14-cylinder two-row unit. Thus the Major is in effect a return to type. Its fairly distant French relation is the S.N.E.C.M.A. 14X—a good engine, incidentally, which might be regarded as an insurance —together, possibly, with the Wright seven-cylinder R-1300— by any who may have doubts about the Major's readiness.

The Leonides Majors now flying in the ex-Mamba Marathon H.P.R.5 are in fact the inboard power units, forward of the firewall, for the Herald. This was a convenient and economical way of providing for the Herald's forward needs at the same time as meeting the development contract for the Majors. The H.P.R.5 at present flies entirely under an M.o.S. contract and this will help Handley Page to keep the cost of the Herald at about the £130,000 mark announced—a modest figure and, incidentally, one to embarrass any foreign competitor.

Early flights of the H.P.R.5 have shown that cylinder temperatures on the Majors remain very low and that oil-cooling capacity should be more than adequate for the hottest climates.

When S/L. Hazelden has completed the preliminary handling—it was he who made the first flight from Reading—the aircraft will be taken over by Alvis, Ltd., who will proceed with flight development at Coventry. The aircraft first flew on the afternoon of Tuesday, March 15th, completing 30 minutes of handling after a very short take-off and rapid climb. Johnny Williams, Alvis test pilot took off at the same time in the Leonides-Consul to observe the flight and provide immediate air-to-air inter-communication. After a preliminary period of flying, the engines will be stripped down for complete inspection, then re-assembled and left to carry on for a much longer period.

Leonides 9 development is now carried out in Provosts and a Prince, the original Leonides Consul having just about completed its long test service. Helicopter units, both 9- and 14-cylinder, will be flight-developed, as hitherto, at Bristol. There is reason to believe that a D.H.C. Otter will be converted to Leonides Major power in due course. With this power, an already outstanding aircraft should become truly remarkable.

Inventory of Inventions

GOVERNMENT statistics, especially when they deal with financial matters, seldom make stimulating reading. Occasionally, however, time spent in perusing Blue Books, White Papers *et hoc genus omne* will yield unexpected items of interest. Such was the reference to the cost of the Princess flying-boats (see *p.* 343, *Flight*, last week), made in the Auditor-General's report on the Civil Appropriations Accounts; and even the Accounts themselves (H.M.S.O., price 9s) are not entirely an arid desert.

In one of the appendices, for example, is a list of the sums paid out as Awards to Inventors during the year ended March 31st, 1954. Adding up to the not very impressive total of £241,856, they include quite a number of aeronautical items, some of purely Army import, and others of an indeterminate nature. Unmistakably aviation inventions figure in the list, with the sums awarded, as follows:—

Aircraft designs, £100,000; automatic pilots (five cases—£8,500, £1,500, £400, £250, £100), £10,750; day/night flying training equipment (two cases—£7,000, £250), £7,250; Sommerfield track and flex boards, £5,000; retractable gunsight mountings, £4,369; use of invention in a prototype Lysander aircraft, £2,500; apparatus for discharging illuminating cartridges from aircraft, £500; quick release gear—Horsa glider, £500; modifications to bomb trolleys, £400.

Honouring King's Cup Victors

THE Royal Aero Club buzzed with air-racing reminiscences on the evening of March 16th, the occasion being a dinner for King's Cup winners between 1923 and 1954, of whom seven managed to be present. Though this was a disappointingly small number, messages from some of the absentees showed that they were not allowing the occasion to pass unmarked. A.V-M. R. L. R. Atcherley, the winner in 1929, had notified the secretary, Col. Preston, that he had flown to California to dine with Capt. Frank Courtney, who was first in 1923.

The company was saddened to hear that F/L. H. M. Schofield, who won in 1934, was ill in hospital; Capt. Percival was down with 'flu, and Alex Henshaw was in New Zealand.

Col. Preston remarked that, contrary to pre-war circumstances, sporting flying today was entirely amateur. It had often been asked why the round-England course had been abandoned, and he gave two explanations—first, the difficulties created by Britain's civil air routes, and second, that 78 per cent of potential entrants had asked for a short course, having regard to engine life.

Lord Brabazon congratulated Maj. Mayo and his associates in keeping the contest keen by their wonderful handicapping. Speed, he said, was not necessary to an exciting race. It might well be that the sport of flying would be regenerated through ultra-light aircraft. Capt. "Wally" Hope—three times winner—was sad not to see "D.H. and some of the old boys who used to kick one around." Speaking for the post-war winners, "Nat" Somers said that one of the greatest things about the King's Cup Race was that it entailed a good deal of luck. He thanked the organizations who gave fuel, oil and other necessities, and confessed the thrill he experienced on arriving for a race and seeing for the first time "the tents and the different-coloured aeroplanes."

Mrs. Adams (formerly Miss Winifred Brown, popular winner in 1930) said that sporting pilots today were fighting much the same battle as in the old days—and were fighting it just as well. She recalled taking her son, then aged 11, to one of the races of 1950. On the way, the young man asked why his mother no longer participated in air racing, and she was forced to admit that she just could not fly the fast modern aeroplanes. Arriving, however, she found that the machines were all of her time.

Sir Alan Cobham—in tremendous form notwithstanding a severe cold—harked back to the days when he was making £200 a year with de Havillands plus "a bit on the side"—notably by selling D.H.9s, which he had bought for £22 10s. apiece, for £92 10s. He recalled, too, how, under the late George Robey's

SPORTSMEN ALL: At the Royal Aero Club dinner to King's Cup winners between 1923 and 1954 (a report appears below) are: (Top, left to right) Sir Alan Cobham, "Freddy" Rowarth, Mrs. Adams (formerly Miss Winifred Brown), Maj. R. H. Mayo and Lord Brabazon. In the second group are Walter Bowles, "Nat" Somers and E. H. W. Lucas.

patronage, a 450 h.p. Napier Lion had been "stuck into" a D.H.9 for the race of 1923 and how that venerable aeroplane had thereby been dragged through the air at 160 m.p.h. Sir Alan's account of the race held the assembly enthralled by its graphic spontaneity.

Tommy Rose recalled that he had more fun baiting the handicappers than in the race itself—though one had to be careful not to overdo that pastime for fear that a decimal point might be moved in retaliation. Freddy Rowarth—past-master of handicapping—said that he would never forgive "Wally" Hope, for he was the only man ever to do the handicappers down. He remembered a telegram being received in his house from Tommy Rose, reading: "Freddy, you old ——, what do you think I am flying, an S.6?"

Maj. Mayo, chairman of the racing committee, paid tribute to his great personal friend Capt. F. L. Barnard, three times winner, who had been killed testing the Bristol Badminton for the race of 1927.

Bristol Executive Appointment

Mr. W. U. Snell, M.I.Mech.E., M.I.P.E., A.F.R.Ae.S., has been appointed executive assistant to A. Cdre. F. R. Banks, a director of the Bristol Aeroplane Co., Ltd. Originally in the motor industry, Mr. Snell came into aircraft in 1934, being successively with Pobjoy Airmotors and the de Havilland engine and propeller companies. He joined Bristols in 1947 and has been chief executive of the engineering department of the engine division for the past four years.

Ford Hunter Accident Verdicts

AT the resumed inquest at Chichester last week on a Naval chief petty officer, his wife, and a petty officer, all three of whom lost their lives when a Hawker Hunter struck caravans near the perimeter of the airfield at Ford on January 25th, verdicts of death by misadventure were returned in each case. The Coroner said that there was no evidence whatever on which to assume negligence, adding that the jury would agree that the pilot of the Hunter—Mr. Frank Murphy, Hawker's chief production test pilot—"behaved in the very best traditions of his profession."

Giving evidence, Mr. Murphy—who received injuries in the crash—said that his engine stopped, and would not restart, when he was 45,000 ft above the South Coast. He established radio contact with Ford and dived down to attempt a landing.

"I attempted to lower the emergency flaps," said Mr. Murphy, "but was unable to do so, which meant that, lacking braking power, I had to land by diving on to the ground at the beginning of the aerodrome in the hope that I would stop within the length."

The aircraft had touched down and proceeded across the airfield in a series of bumps (here the coroner interposed that photographs taken afterwards showed that the Hunter had touched the ground 19 times). Mr. Murphy added that the machine had run off the airfield, veered left and continued in a straight line, though going sideways. "Vibration was very intense," he said, "and I could not see anything." The flaps came down just before he touched down; it was reasonable to think that had they not failed he would have been able to stop within the aerodrome. He tried to land with his wheels up to act as a brake.

Mr. D. Cameron-Douglas, senior investigating officer of the M.T.C.A. Accident Branch, said that examination of the wreckage showed that the flaps had operated; with due respect to Mr. Murphy he might not have operated the release in the first instance. Examination of the engine had shown that the fuel system and igniter plugs were in order but a broken wire had been found in the circuit of the relighting system; he was practically positive that the breakage had occurred during flight.

U.S. Trans-continental Record

THREE fighters of the U.S.A.F. succeeded in breaking the Los Angeles-New York speed record on March 10th by covering the 2,445 miles in less than four hours. Eight machines set out, but five failed to arrive at New York. The fastest of those successful, a Republic F-84F Thunderstreak piloted by Lt-Col. Robert Scott, averaged 649 m.p.h., cutting 19 min 43 sec off the January 1954 record (4 hr 8 min 5 sec, 615 m.p.h.) by Col. W. K. Millikan in an F-86F Sabre. On landing, Col. Scott commented that the times would have been better had the aircraft not had to "slow down almost to stall" to refuel from "the obsolete old tankers."

Col. Scott failed to break the U.S. Navy's San Diego-New York trans-continental record (seven miles shorter than the Los Angeles-New York course) set up in April last year by Lt-Cdr. Francis Bady, who flew a Grumman F9F Cougar between those points in 3 hr 45 min 30 sec.

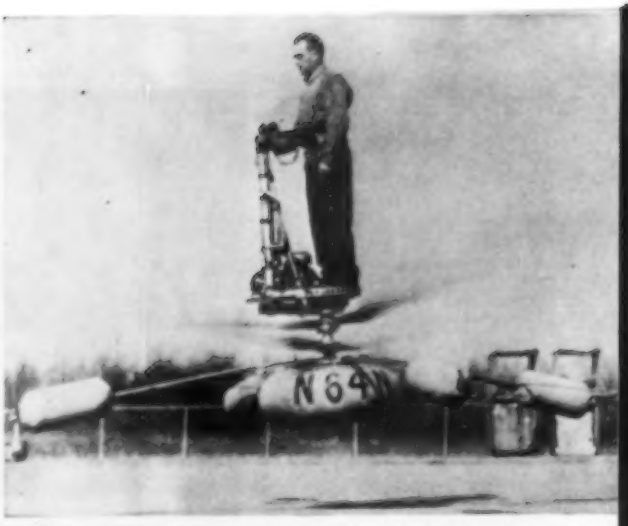
Aviation Art

AT the recent inaugural meeting of the Society of Aviation Artists the following were elected painter-members: George Ayling; Laurence C. Bagley; Frank E. Beresford; Leonard Bridgman, F.R.Ae.S.; A. Egerton Cooper; Roy Cross; Charles Cundall, R.A.; Terence Cuneo, G. H. Davis; Geoffrey Draper; W. Howard Jarvis; Kenneth McDonough; Edward Newling; Roy Nockolds; Cuthbert Orde; Keith Shackleton; David R. Shepherd; Charles F. Turner; Norman Wilkinson, C.B.E., P.R.I., R.O.I.; Leslie A. Wilcox, R.I.; Frank A. A. Wootton; Colonel Harold Wyllie, O.B.E.; Miss Pamela Drew.

Officers were appointed as follows: President, Norman Wilkinson; vice-president, Frank Wootton; hon. secretary, Roy Nockolds; hon. treasurer, Leonard Bridgman.

The annual exhibition is to be held in London next September.

HERE AND THERE



STANDING UP TO IT: This highly unorthodox helicopter is the work of aircraft engineer Lewis C. McCarthy, of Westchester County, New York. Lesson one seems to be not to step off while the contra-rotors are in motion.

Honoured Guest

TOWARDS the end of April Mr. Igor Sikorsky will pay a short visit to this country, both to see something of the British helicopter industry and, on the 29th, to receive his James Watt Medal from the Institution of Mechanical Engineers. A dinner will be given in his honour by the Helicopter Association and he will be a guest at Westlands, Bristols and Faireys.

Postal Catalinas

TWO Catalinas of the Norwegian Air Force recently flew to ice-bound Spitsbergen and Bear Island in the Arctic with mail for Norwegian miners and meteorologists there. The aircraft to Spitsbergen carried more than a ton of letters or parcels for dropping at four different settlements.

Canada to California

FORMER production engineer of A. V. Roe Canada, Ltd., Mr. A. M. Davis has joined the powerplants division of Marquardt Aircraft Co. (Van Nuys, California), as chief of engineering and manufacturing services. Marquardt are large-scale producers of ramjets and afterburners.

On the Road

DATA on many of the world's leading sports cars will be a feature of the special Sports Car Number which our associated journal *The Autocar* is publishing next Friday, April 1st. Another seasonable publication for road users is the special Easter Number of the *Motor Cycle*, appearing on Thursday, March 31st.

Leaving the S.B.A.C.

THE Society of British Aircraft Constructors will shortly lose the services of Mr. M. G. Ionides, B.A., M.I.C.E., their deputy director since 1949. He is returning to Iraq (where he was Irrigation Engineer from 1926 until shortly before the war) as the outcome of a request to the Government from Baghdad to nominate a British specialist to join the Iraq Government Development Board. The Board is carrying out a £30m development scheme, based largely on industrial expansion, irrigation and the provision of hydro-electric power.

Mr. Masefield I. of T. President

AT last Friday's annual dinner of the Institute of Transport the president, Sir Gilmour Jenkins, announced that his successor for the session commencing October 1st, 1955, would be Mr. Peter Masefield, chief executive of B.E.A. Mr. Masefield, who was elected a vice-president in 1953, has made many contributions to the proceedings of the Institute, the most noteworthy being his Brancker Memorial Lecture in 1951.

For Popular Flying

CONSTRUCTION of the first amateur-assembled aircraft under the new "ultralight" certification system will have a ceremonial send-off at Hatfield Technical College tomorrow, March 26th, when Mr. Peter Masefield "lays down the keel" of a Druine Turbi (Walter Mikron). Students of the College hope to complete the two-seater at a cost of £300.

Chipmunks Reinstated

THE de Havilland Aircraft of Canada, Ltd., is once again to build D.H.C.1 Chipmunks, over 1,000 of which have been produced to date by D.H. Canada and D.H. England. This is disclosed in a recent announcement, which adds that production of a substantial number of Chipmunks for the R.C.A.F. will start immediately, with first deliveries scheduled for July this year. The "Chips" will be distributed through four Service flying training schools to provide indoctrination flying prior to commencement of basic flying training on Harvards. Evaluation has been under way for the past year at No. 1 S.F.T.S., Centralia, Ontario.

Factory Equipment on View

SIR MILES THOMAS, chairman of B.O.A.C., is to open the National Factory Equipment Exhibition next Monday (Earls Court, London, March 28th-April 2nd). Admission to the exhibition—a feature of which is to be mannequin parades of industrial clothing—is either by trade invitation or on payment (2s 6d) at the doors; hours are from 10 a.m. to 7 p.m. (6 p.m. on the Saturday).

Warton Appointments

ENGLISH ELECTRIC announced last Tuesday that W/C. R. P. Beamont, while continuing to carry out duties of chief test pilot, is promoted to the post of manager flight operations, in which he will be responsible for the co-ordination of all flying activities and liaison with the Air Ministry, Ministry of Supply and establishments. Mr. D. de Villiers (portrait below) is appointed chief experimental test pilot, responsible to the manager flight operations, and Mr. J. W. C. Squier is appointed chief production test pilot.

WELCOME AT GOSSELIES: Bringing a Hawker Hunter—a manufacturing "sample"—from England on March 16th, Avions Fairey test pilot P. I. R. Andersen was welcomed at the company's airfield by Mr. E. O. Tips, the managing director. Avions Fairey are beginning production of Hunters for NATO.

CHIEF TEST PILOT to de Havilland Propellers, S/L. Desmond de Villiers—seen in this photograph, it will be observed, in a Swift—is shortly going to English Electric as a chief experimental test pilot under W/C Roland Beamont. He will be succeeded by Michael Kilburn, a D.H. Aircraft production test pilot at Chester.

ANY FIELD AN AIRFIELD

—*or, How to Become Independent of 8,000 ft of Concrete: The Blériot Lecture*

ON Thursday of last week, the eighth Louis Blériot Lecture [by M. Georges Hereil, general manager of the French S.N.C.A.S.E. national aircraft group] was read before the Royal Aeronautical Society by Prof. A. R. Collar. Choosing as his title "Making Aeroplanes Independent of Runways," M. Hereil presented a valuable compendium of most of the principal experiments which have been adopted with this aim in mind. A considerable proportion of these experiments were of French origin and—though the paper did not make this particular point—France certainly seems to be devoting a greater proportion of her national income to this type of development than any other country.

The paper began by summarizing the various factors leading to the employment of, and the disadvantages of, large runways. Of the latter, the three most important were the very great expenditure required, the lack of flexibility imposed upon air forces and the vulnerability of large fixed bases. There were two distinct points to be considered in discussing the take-off and landing of aircraft: the ground area and the type of surface necessary. In the first case, the determining factors were the wing-loading, the lift and the accelerating and braking power available. In considering the second point, the determining factor was runway-loading. M. Hereil deliberately confined his attention to means for launching and retrieving conventional fixed-wing aircraft and, in particular, concentrated upon devices which could be rapidly applied to orthodox machines. He did not consider any type of V.T.O. aircraft, aerodynamic solutions or those using engine power, water-based aircraft or helicopters.

It was of interest to note that, throughout the history of aerodynamics, inventors had conceived devices which, although not exactly solving the problems currently being met, embodied the essentials of the modern solutions. The great interest raised by the problem was shown by the number of patents granted in the U.S.A. between 1904 and March 1952; 158 such patents were solely concerned with devices for launching aeroplanes by catapult.

The first major part of M. Hereil's paper dealt with the limitations of runways as they exist at present. Financial outlay was the first real limitation and, of this, the major portion was due to the amount of labour involved and the need to use mechanical means for construction. It was necessary to employ a level tract of land several miles in length and, once the construction was completed, the region was irretrievably lost to cultivation.

As an example, figures were given for a typical NATO airfield in France. The airfield comprised: a 2,600 yd runway, 50 yd wide, with a 65 yd border on each side and a 300 yd over-run at each end; a parallel taxying strip of the same length as the main runway; four connecting strips; several dispersal areas; and various access roads. The average total cost of such a base exceeded £2½m.

It was stressed that the above figures referred to a tactical base for fighter/bombers; for medium bombers of the B-47 type the average cost of an airfield was £10½m. The building of airfields was thus seen to place a heavy burden on military budgets and, in the 1952 French budget, appropriations amounted to £63.6m for airfields as against only £54.4m for aircraft production.

Civil airports were still more costly. Figures for large airports included: Idlewild £35m, Grand Orly expansion scheme £30m, London Airport £20½m and Newark £18m. It was true that in this case the cost of the runways was only about 20 per cent of the total and, furthermore, that a civil airfield was more or less permanent. Considerable sums had already been spent on the establishment of world air routes; by January 1st, 1950, the total cost in the U.S.A. alone had already reached £350m of which £230m was for trunk-route airfields. Each year new airfields were completed and new airports open to traffic. This meant that, in so far as civil aircraft were concerned, the need to find a means of eliminating runways lost some of its importance. On the other hand, it was feasible that, while still using ground runways, some of the methods designed to make military aircraft independent of them could be applied with advantage to civil airliners.

The lecturer then turned to the limitations and vulnerability of runways in military operations. It was pointed out that there were many actions during the second World War and in Korea when air operations were paralysed by a shortage of usable airfields. With the piston-engined World War II aircraft, it had been possible to improve deployment by using sections of *autobahn*, but jet aircraft were not amenable to such operations. In Korea, for example, the U.S.A.F. averaged approximately 260 daily sorties when operating the same number of aircraft as achieved 5,000 sorties on the Ardennes front in 1944.

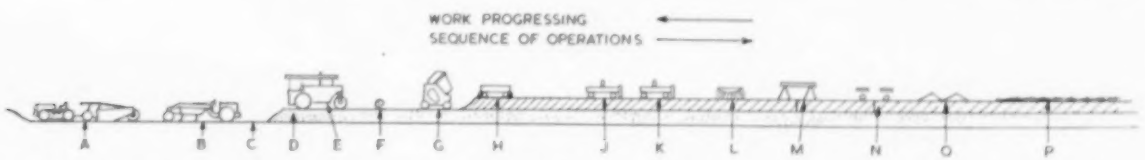
The possibility of a requirement for large numbers of tactical bases close up behind moving armies led naturally to a discussion of the time factor involved in the construction of present-day runways. Recent military history provided two good examples of this factor. The first related to a Berlin Airfield; the Tegel base, built during the most critical period by 17,000 German labourers working in three shifts, took three months to build. The second example was from Korea; K6 airstrip was started on September 16, 1952, and was not completed until February 13th, 1953 [Very much better times than this have been established by American airfield construction battalions—Ed.]. The accompanying sketch shows some of the many different operations responsible for the long time taken to complete modern runways. The important work of excavation and removal of about 14,000,000 cu ft of soil obviously needed powerful tractors, scrapers, bulldozers and graders and so forth; and, for surfacing, a concrete mixing plant with an output of over 3,500 cu ft per hour had to be established on the site.

The next illustrations in M. Hereil's paper were of World War II airfields immediately after heavy bombing attacks. It was, said M. Hereil, impossible to camouflage a large and important base and the whole installation was very vulnerable to attack even with ordinary bombs. If nuclear weapons were used, not only would the destruction be widespread but also, owing to radioactive contaminations, the effect could last for several days, during which time the airfield would be out of action. Thus it could be seen that large airfields caused grave concern to technicians and military commanders whose efforts were directed towards the same object—never to construct an objective important enough to justify an atomic attack.

The paper then went on to discuss the conditions and requirements which had gradually led to the necessity for long concrete runways. These factors included increases in all-up weight and in tyre pressure, increases in wing-loading and the adoption of more stringent international requirements and operating procedures to provide airfields properly matched to civil transports with the maximum safety.

The lecturer next turned to the main subject for consideration in the second part of his paper, which began with a list of the various means for making aircraft independent of runways.

Strictly speaking, catapults were *launching* systems. Since the original example of the catapult used by the Wright Bros., these devices had been employed mainly on aircraft carriers. It was worth noting that, whereas for a long time the aircraft to be launched were carried on rail-mounted trolleys, present-day naval catapults consisted of an accelerating claw flush with the deck attached to the aircraft by means of a strop, the wheels of the aircraft actually running along the flight-deck itself. It was for this reason that aircraft design for carrier work frequently required tyre pressures greater than those for corresponding land-based



Some of the principal operations involved in constructing a concrete runway: A, tractor and scraper; B, motorized grader; C, grading surface; D, sand fill; E, roller for compacting the sand fill; F, roll of Kraft paper; G, concrete batch-mixer; H, concrete spreader; J, "pervibrateur" finisher, K, "poutre vibrolisseuse" finisher; L, sweeper; M, expansion joint; N, joint finishing; O, tarpaulins; P, layer of hay.

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ANY FIELD AN AIRFIELD . . .

aircraft, in order to accept the considerable vertical load during catapulting.

Ground catapults were at a disadvantage (compared with those used on aircraft carriers) in that they had to be provided with a source of power and they could expect no help from head-winds —at best they could be erected in the direction of the prevailing wind. Catapults in the field also had to possess the essential quality of mobility; the weight and the labour required for dismantling an assembly had to be as low as possible, and another desirable factor was that the delay between the launching of one aircraft and the next should be as short as possible. At present ground catapults were not normally used with piloted aircraft. Most of those that had been constructed had been to determine the best type of propulsive system and the optimum method of application.

The principal variables in the design of ground catapults were the form of propulsion used (electricity, compressed air, steam, explosive charge, etc.), the method of starting the aircraft (sliding or rolling trolley, rail track, aircraft running on the ground) and the type of drive used (towing cable with reeving, or unrolling from a truck, direct towing by a hook, or a reaction force).

The steam catapult [described in *Flight* of January 21st] employed a piston mounted inside a slotted cylinder supplied with steam from a generator. The slot was sealed by a flexible cable which moved with the piston and was pressed against the lips of the slot by the steam pressure. This principle was used in the German catapult which launched the "V-1" flying bomb, but in this case the propulsive force was the reaction of liquid propellants. It was M. Hereil's belief that a similar device using a cordite charge had been tried out in Great Britain last year.

General conclusions regarding catapults were that the cost of launching was quite small, the possibilities of camouflage were good and that as an operational device it had much to commend it. Nevertheless, the time required to load aircraft for launching was a drawback, which might require multiple catapults; and such devices also did nothing to solve the problem of landing.

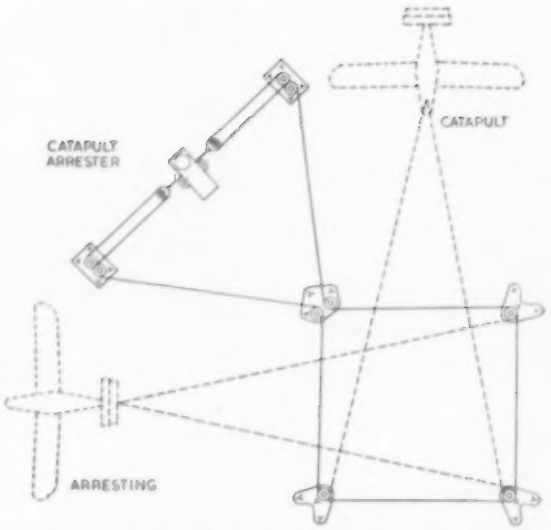
A particularly interesting type of catapult known as the Arbalète has been designed by M. Feuix, consulting engineer to the Schneider works at Le Creusot. Compared with conventional catapults, the Arbalète contained original characteristics which required separate treatment. The principle was shown in the accompanying sketch, in which the positions could be seen of the various ground pulleys, the reeving system with fixed and moving sheaves and the system for supplying and storing energy.

In the launching position, the aircraft was attached to the cables to form an acute angled "V," the cable being kept taut by pressure (provided by, for example, compressed air). The aircraft was restrained by a hold-back link which was released as soon as the forward-thrust reached a pre-determined value. Acceleration by the cable ended when the cable became perpendicular to the path of the aircraft. The Arbalète could also be used to reduce the landing run. In this case the aircraft picked up the cable in a manner similar to that employed on aircraft carriers. The sequence of landing automatically reloaded the equipment for a new launching without consuming any other energy. If the time factor or other circumstances demanded different arrangements for take-off and for landing the reloading could be done by winching the cable, or take-off trolley, back to the starting point.

Very successful experiments were made in France a few months ago, involving take-off and landing of an N.C.856 artillery observation machine weighing about 2,000 lb. In this case the cable was passed around a system of sheaves anchored by steel stakes forming a square of side 40ft. This arrangement provided for four take-off or landing directions, the positions chosen being such as to gain the most advantage from the prevailing wind. The power system comprised a piston driven by compressed air (at a maximum of 210 lb/sq in) from an oleo-pneumatic accumulator. A piston pulled a heavy cable via a primary reeving system which, in turn, actuated two secondary reevings to move the cable towing the aircraft; the total reeving ratio was 25 : 1.

The N.C.856 was equipped with a small towing hook at the front of the aircraft, a hold-back link attachment at the rear, and a small retractable hook for landing. The following results were obtained: take-off in 24 yd instead of 120 yd and landing in 15.3 yd instead of 99 yd. This installation required only two strips of ground at 90 deg to each other, each 55 yd by about 15ft. The strips did not need to be particularly level and a team of four men could install an Arbalète in two hours.

The lecturer then turned to discuss the various types of prefabricated metal track which could be used as a cheaper and readier substitute for concrete runways. Although lacking the strength and durability of concrete runways, metal track could with advantage be used on temporary airfields to distribute the wheel load over an area larger than the tyre contact area and to delay deterioration of the ground due to wheel friction. On the other hand, there were two serious disadvantages. The ground under the track remained damp and, during constant use in bad weather, mud and water were pushed up through the track and eventually made the runway unserviceable. To some extent this problem and also that caused by dust in dry weather could be counteracted by laying straw between the ground and the track. In addition, since the ends were not fastened, the track panels tended to rise at the ends, causing very dangerous projections. A track 2,200 by 55 yd cost some £120,000 excluding labour and transport; about 8,600 man-hours were needed to put it down, a large labour force being needed for rapid assembly. The track could, however, be recovered and put down elsewhere if required.



Rough plan of the Arbalète, showing, approximately to scale, N.C.856 A.O.P. machines in the accelerating and arresting position.

The load-bearing capacity of such a track was determined essentially by the ground beneath. In the most favourable conditions aircraft with wheel-loads of 12 tons and tyre pressures of 100 lb/sq in could be accepted.

Any aircraft launched by a horizontal catapult had to attain its maximum forward speed before leaving the launching device. This, coupled with the maximum acceleration endurable by the pilot, determined the length of the accelerator. If, instead of being catapulted horizontally, the aircraft were launched along an inclined path, the restrictions were reduced. Wing-lift needed to be only a fraction of the weight and, in general, it should be possible to leave the guide-rails of an inclined ramp with forward speed only just sufficient for control effectiveness (say 60-75 m.p.h.). Allowing an average acceleration of 3 g, the launching length need be no more than 50ft.

Ramp launchers had two major advantages over catapults; a very small space was needed for the installation and the launching device was so simple and compact that it could remain on the vehicle used for its transport. On the other hand, rockets still cost of the order of £7 10s per ton of thrust per second so that, to launch a machine weighing only three and a half tons at an acceleration of 3 g for three seconds, the cost became £225. If, to hide smoke produced during the launching, an uncleared site were employed, landings would have to be effected elsewhere; in any case, aircraft-hoisting equipment was necessary and the launching rate could never be high. These considerations indicated that ramp-launching would be more suitable for guided missiles than for manned aircraft; in particular the problem of their return would not apply. M. Hereil recorded that, using experience gained by launching pilotless bombers, the U.S.A.F. had conducted successful experiments with ramp-launching of manned fighters (F-80C and F-84G).

The lecturer then turned his attention to horizontal take-offs from railed carriages. The advantages of such an arrangement were: the rails were able to take concentrated loads on any type of ground; in wartime, the existing rail network could be used for the transport of the carriages, hoisting and maintenance gear; the problem of directional control did not arise; and, following air attack, experience had shown that repairs could be effected in a matter of hours. On the other hand, this technique combined nearly all the disadvantages of the previous solutions and also did nothing to solve the problem of landing.

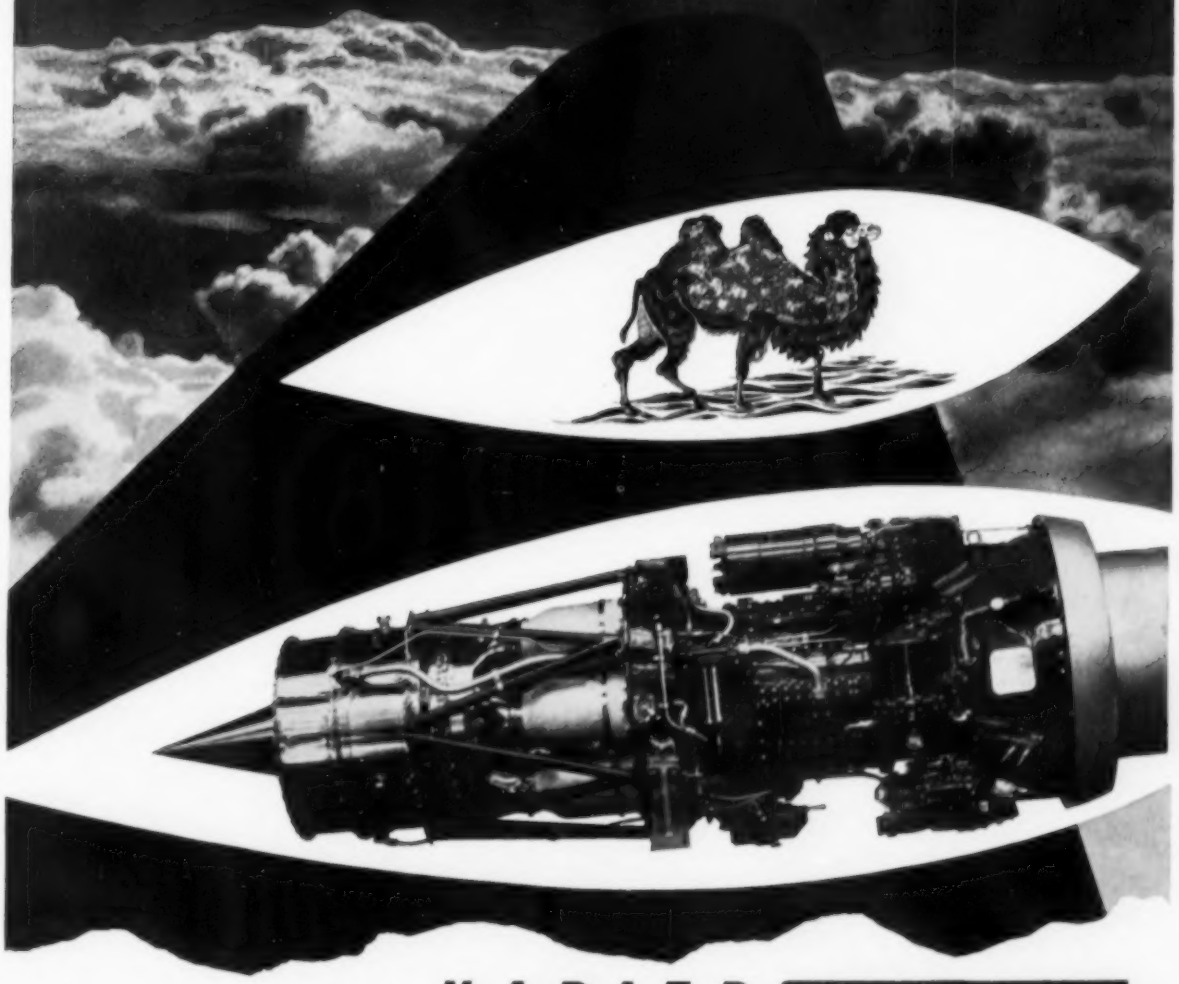
In the first place there had been a number of systems, some of them used successfully in practice, by which aircraft were helped into the air or retrieved by a system of cables supported well

low fuel consumption

Specific fuel consumption of the Napier Eland propeller-turbine is very low indeed—0.450 lbs./e.h.p./hr. at 36,000 ft. 400 knots cruising, or 0.505 lbs./e.h.p./hr. at 20,000 ft. 350 knots cruising. This means a great deal to the operator in terms of payload, performance and direct operating cost.

more facts about the Eland

* High aerodynamic efficiency—3,000 e.h.p. in a maximum diameter of 36 inches.
* Low specific weight—0.52 lbs./e.h.p.
* Easy maintenance—independent unit construction.
* Ease of control—single lever control, with manual over-ride, guards against engine over-speeding and over-fuelling.
* Automatic temperature compensation.
* At the first attempt the Eland has recently passed a 150 hour type test rehearsal at the full 3,000 e.h.p. rating.



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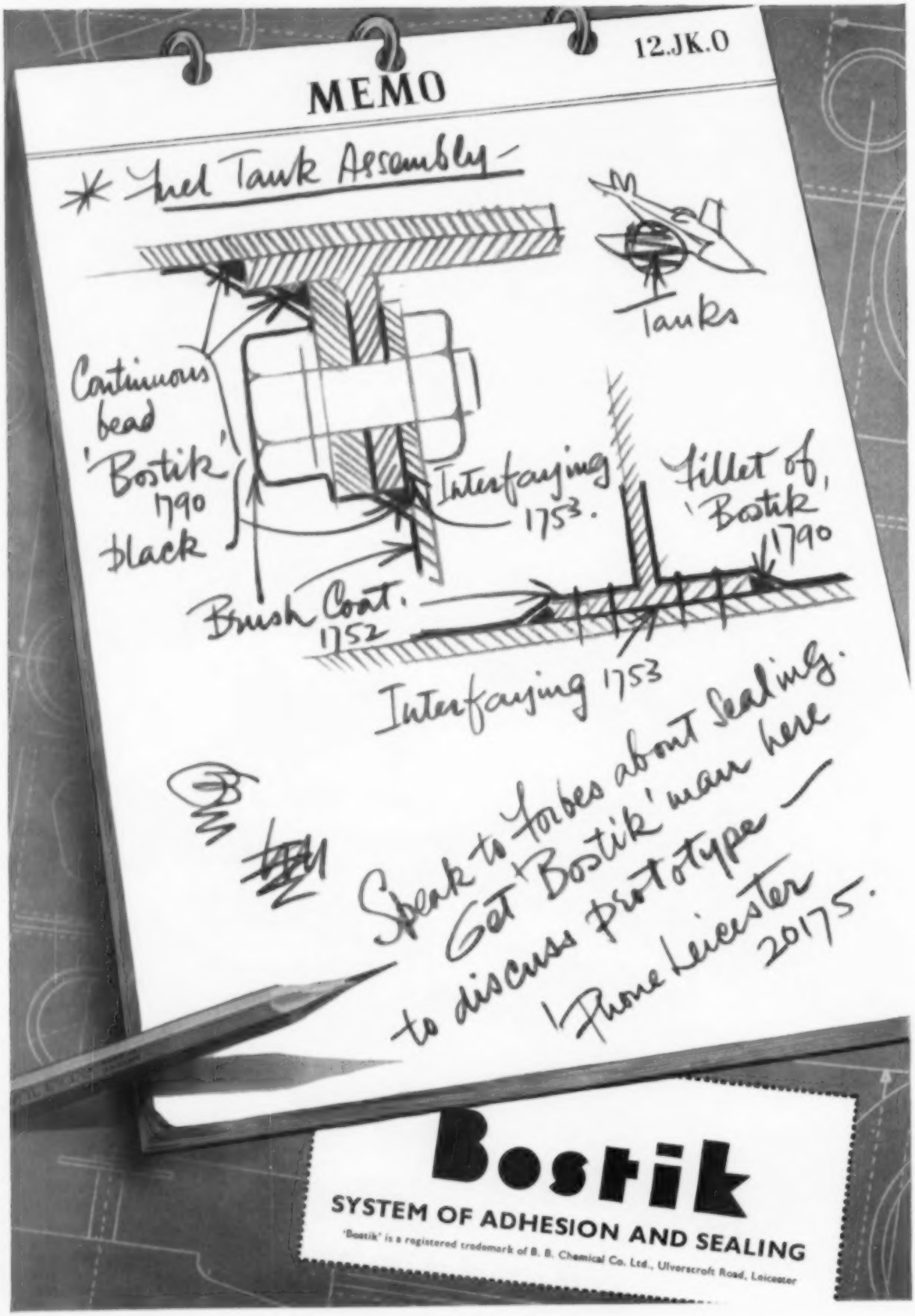
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The second prototype Baroudeur being winched up on to its trolley by a Delahaye utility truck, the trolley being held by the rigid towing bar.

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above ground level. One of the foremost of these was that designed by Captain Brodie of the U.S.A.A.F. in 1942 and employed with liaison aircraft in the Pacific theatre both on the ground and on cargo boats.

A very different cable take-off system was designed a few years ago by M. Renollaud, of the French D.O.P. Company. The system studied in most detail consisted of a light iron track with grooved rails in which were laid hempen ropes impregnated with kerosine. The aircraft was fitted with skids of semi-circular section fitting closely upon the ropes. During take-off, the machine was supported and guided by the ropes, the latter being lubricated by a kerosine pipe leading to the front of each skid. The coefficient of friction was found to be 0.08 between the chrome steel skid and the rope and wear was found to be negligible. With a Nene-powered Mistral fighter, the take-off run was measured as 707 yd, 65 yd more than with high pressure tyres.

Turning to considerations of landing, M. Hereil said that it was pointless to devise a means for eliminating a runway at take-off without at the same time providing any scheme to allow the aircraft to land. In addition to braking cables and safety barriers, there were less conventional arrangements. The first was the use of a flexible platform suspended above the ground. Using a sheet of reinforced rubber it was found that it was possible to absorb most of the energy of landing by the inertia of the platform before transmitting loads to the supports. Another method was that tried in Great Britain in which a landing mattress was made up of a series of inflated rubber cylinders, between three and four feet in diameter, covered by a smooth sheet. Horizontal deceleration was effected by a conventional arrester cable and hook and a normal airframe could be used with some reinforcement to the belly. It was also essential to cut the engine to avoid deterioration of the mattress by jet efflux. It appeared that Great Britain had ceased experiments, although studies along the same lines were now going on in the U.S.A.

At first sight, one of the simplest methods of eliminating runways was to employ aircraft with low-pressure tyres and/or multiple wheels or caterpillar tracks. Experiments had shown that tyre pressures of about 35 lb/sq in would be needed for reasonable operation from meadows and similar surfaces. Tyres with such low pressures involved a considerable increase in weight, shown by the fact that to support a static load of 8,000 lb a 43 lb/sq in tyre weighed 118 lb, 70 lb more than a tyre working at 235 lb/sq in. Retraction problems were also aggravated.

In a brief history of caterpillar track gear, the paper mentioned the fact that, in 1940, a Dowty caterpillar track was fitted to a Westland Lysander but, owing to other priorities, was not developed. The most advanced such units were those used on B-50 and C-119 aircraft in the U.S.A., the former machine supporting 54 tons with a dynamic pressure not exceeding 50 lb/sq in. In operation, the rear rollers supported most of the load, the front roller being used to surmount obstacles. American trials showed that, in a strong sidewind, the belt tended to go off the rollers; other troubles included track locking during heavy brake applications, the difficulty of retraction, and an increase in weight and rolling friction.

There were very many examples of aircraft fitted with a ski or skid undercarriage, for use on all types of surface including water. On snow, the coefficient of friction could be less than the best rolling value (about 0.03) which could result in very short take-off runs. The disadvantage lay in the tendency to ground-looping and in lack of resistance to side-slip in cross winds. On most other types of ground, friction was greater than with wheels, and special precautions had to be taken to disperse the heat produced.

The main advantage presented by skids was the possibility of obtaining very low ground pressures; on the S.E. 9000 Baroudeur (described in our issue of August 6th, 1954) it was no more than 14 lb/sq in. Compared with caterpillar tracks, the skid cylinder was simpler, lighter and less bulky. The use of skids at take-off was related to the thrust/weight ratio and the ground friction. For stony ground or dry clay, the coefficient of sliding friction varied from 0.25 to 0.3; on slightly damp turf the value was about half this (rolling friction for low-pressure wheels, about 0.12). Direct take-off on skids was certainly possible for modern jet fighters, as the Baroudeur had proved.

On the Baroudeur the skids were hinged about generally longitudinal axes so that, by using the lateral component of friction, the energy of landing could readily be absorbed. During take-off the skids were aligned parallel to the direction of travel but they were splayed outwards during the landing run to increase deceleration. Since skids lent themselves to good aerodynamic design it was possible that retraction might become unnecessary. It had been found that coefficient of friction could be greatly reduced by moistening the ground and it was probable that, by injecting water under pressure of compressor-bleed air, friction between the skid and the ground could be reduced to the value for low-pressure wheels. Ground manœuvring with skids could be improved by fitting small rollers, the most successful scheme of this type being another development by the D.O.P. Company (described in our last issue).

Of all the take-off systems envisaged, the multi-purpose undercarriage was the least dependent on ground equipment. In principle, the system followed early ideas of separating the parts of the aircraft used for take-off from those necessary for flight. Typical modern examples were the German Me 163B, and the Canadian de Havilland Beaver.

There were, of course, many stringent requirements in the design of a take-off trolley and the trolley and aeroplane combination had to ride smoothly under pilot control at all speeds while being directionally stable. There had to be no fouling between the aircraft and control even during separation in a strong cross wind and the problems became more acute if, as was desirable, the trolley was designed to carry take-off rockets and a braking device. The trolley used by the Baroudeur was a unit made from welded steel sheet with four wheels mounted on compressed-rubber shock-absorbers. The aircraft was supported laterally at two points and also by a rear roller with which the angle of incidence could be changed; actual attachment was effected at one point only. The pilot started the take-off run on jet thrust and, at a speed dependent upon aircraft weight and rocket power, accelerating rockets attached to the trolley were fired. The pilot had differential control of the rear wheel brakes on the trolley, and the main flying controls of the aircraft became effective at 56 m.p.h. When the rockets ceased firing, it was possible to unlock the release catch, following which application of elevator caused the aircraft to become airborne. The release of the aircraft also applied the brakes on the trolley. After the Baroudeur had landed on its skids the trolley could be towed up to the aircraft and the latter winched thereon within two minutes, as shown in the photograph above.

The final section of the paper dealt with the application of the skid-trolley system to commercial aircraft. It had been suggested that this could lead to a reduction in empty weight of the aircraft and also by permitting the introduction of commercial services in regions without proper airfields. Unbiased calculations showed that it should be possible to reduce undercarriage weight by about 40 per cent and allow an increase of about 10 to 15 per cent in payload. On the other hand, the transport aircraft used in remote areas could quite acceptably employ a fixed undercarriage with low-pressure tyres. It appeared at present that it would be bold to claim that the application of the skid/trolley system would produce favourable results in commercial service at the present time.

LEVEL SONICS

THE firm of Avions Marcel Dassault seem to have profited greatly from the work done by North American Aviation in developing the F-86 and F-100. As each new Sabre was announced its principal features were rapidly incorporated—to very good effect—in the French company's Ouragan/Mystère line. Latest of this line is the Super Mystère, otherwise the Mystère IV B.1; and, although it is scarcely the equal of the Super Sabre, it is certainly among the fastest fighters in Europe.

Compared with its forerunner it has wings and tail surfaces with slightly greater chord and sweep angle, a flattened oval nose intake, a Hunter-like cockpit canopy affording better visibility and a powered "slab" tailplane. The latter feature, in particular, is stated to have effected a marked improvement in transonic handling. The engine is the Rolls-Royce Avon RA.7R, giving about 9,500 lb thrust with afterburner, for which Hispano Suiza hold a manufacturing licence.

The Super Mystère first flew at Melun Villaroche on March 2nd, in the hands of Cmdt. Boudier. In its first three days of flying, the aircraft exceeded Mach 1 four times in level flight and 10 times in shallow dives. The transonic flying took place at 9,200m (30,000ft), which height was reached in 2 min 30 seconds. Having completed Dassault testing, the Super Mystère is now being put through C.E.V. trials; Cmdt. Carpentier, of this establishment, has flown it beyond Mach 1 on many occasions, at altitudes of about 16,000m (52,500ft).

The S.N.C.A.N. (ex-S.F.E.C.M.A.S.) 1402 Gerfaut 1B, also illustrated on this page, exceeding Mach 1 in level flight, without power boosting, on February 11th. Compared with the first version of the Gerfaut, it has a new wing, extending farther forward and farther aft, and possibly with a greater thickness/chord ratio.

The Dassault Mystère IV B.1 (top right) is discussed above. Below it is the SFECMAS Gerfaut 1B which, on the thrust of an Atar 101C, is likewise sonic on the level.

PAPERS ON PLASTICS

DETAILS have recently been issued of the papers to be read at the British Plastics Convention, to be held in conjunction with the British Plastics Exhibition at Olympia, London, from June 1st to 11th. Virtually all the papers, it will be seen, will be of interest to those concerned with the design or production of plastics details for the aircraft industry, and a few are of direct interest to designers of major components. The full list of papers is as follows:—

Polymer Structure and Properties—1 (Thursday, June 2nd, 10.15 a.m.): "Synthesis of New Types of Additional Polymers," by H. W. Melville, F.R.S., Mason professor and head of Department of Chemistry, University of Birmingham.

Polymer Structure and Properties—2 (Thursday, June 2nd, 2.30 p.m.): "Some Properties of Irradiated Polymers," by A. Charlesby, D.Sc., F.Inst.P., Atomic Energy Research Establishment. "Molecular Weight of Polythene—its Measurement and Significance," by S. W. Hawkins, B.A., Imperial Chemical Industries, Ltd. (Alkali Division).

Expanded Plastics (Friday, June 3rd, 10.30 a.m.): "Chemistry of Modern Blowing Agents," by R. A. Reed, B.Sc., Ph.D., F.R.I.C., Genatosan, Ltd. "Technology and Uses of Polyurethane Foams," by L. N. Phillips, A.R.I.C., Royal Aircraft Establishment, Farnborough.

Thermoplastics (Friday, June 3rd, 2.30 p.m.): "Dispersion of Polytetrafluoroethylene," by H. M. Whitcut, B.A., Imperial Chemical Industries, Ltd. (Plastics Division). "New Nylon Polymers and Compositions," by R. H. Birtles, B.A., B.Sc., Imperial Chemical Industries, Ltd. (Plastics Division).

Extrusion (Monday, June 6th, 10.30 a.m.): "Fundamental Problems of Single-screw Thermoplastics Extruders, by E. Gaspar, M.I.Mech.E., Projectile and Engineering Co., Ltd.

Works Study (Monday, June 6th, 2.30 p.m.): "Works Study in the Plastics Industry," by J. Grange Moore, M.A., Central Works Study Department, Imperial Chemical Industries, Ltd. "Productivity and Methods in Moulding," by A. Sparshott, Witton Moulded Insulation Works (General Electric Co., Ltd.).

Injection Moulding—1 (Tuesday, June 7th, 10.30 a.m.): "Effect of Injection Moulding Variables on Quality of Mouldings," by K. C. Bryant, M.A., B.Sc., and G. Hulse, M.Sc., A.Inst.P., Monsanto Chemicals, Ltd.

Injection Moulding—2 (Tuesday, June 7th, 2.30 p.m.): "Recent Advances in Injection Moulding Techniques and in the Evaluation of Materials," by G. Campbell, B.Sc., A.R.I.C., Imperial Chemical Industries, Ltd. (Plastics Division). "Runners, Gates and Vents for Thermoplastics Moulds," by A. G. Elwell, B.I.P. Tools, Ltd.

Patents (Wednesday, June 8th, 10.30 a.m.): "British and International Patent Practice as it Relates to the Plastics Industry," by a chartered patent agent.

Foundry Resins (Wednesday, June 8th, 2.30 p.m.): "Recent Developments in the Use of Plastics in the Foundry," by P. G. Pentz, B.Sc., Leicester, Lovell and Co., Ltd.

Glass-reinforced Plastics—1 (Thursday, June 9th, 10.30 a.m.): "Consistency in Glass-reinforced Moulding," by J. Rees, Plastics Department, Bristol Aeroplane Co., Ltd. "Glass-reinforced Plastics in Automobile Construction," by H. Silman, B.Sc., F.R.I.C., F.I.M., M.I.Chem.E., Ford Motor Co., Ltd., Engineering Research Centre.

Glass-reinforced Plastics—2 (Thursday, June 9th, 2.30 p.m.): "Chemical Engineering Possibilities of Glass-reinforced Plastics, with Special Reference to Polyester Resins," by V. Evans, M.Sc., F.R.I.C., A.P.I. (Prodorite, Ltd.), and J. R. Stevenson, B.Sc., A.R.I.C., A.M.I.F. (British Industrial Plastics, Ltd.). "Testing and Development of High-quality Glass Fibre Polyester Laminates," by P. H. H. Bishop, B.Sc., and E. Haythornthwaite, B.Sc., Royal Aircraft Establishment, Farnborough. "Epoxide Resin/Glass Laminates," by W. J. Marmion, B.A., Plastics and Resins Department, Shell Chemicals, Ltd.

CANADIAN-MADE F. R. EQUIPMENT

As announced last week (p. 343) Flight Refuelling (Canada), Ltd., are preparing for the production in the Dominion of the full range of F.R. pressure refuelling systems. Mr. Dennis Cunliffe, A.M.I.Mech.E., with 22 years' experience in both the British and the American aircraft industries, goes from Blandford to Toronto (922 King Street West) as resident engineer with the Canadian company.

MAINTENANCE of HELICOPTERS

A B.E.A. Engineer Speaks to the Helicopter Association

AT the seventh meeting of the Helicopter Association's 1954-55 lecture programme, held in the library of the Royal Aeronautical Society on March 11th, a paper entitled *Helicopter Maintenance* was read by Mr. J. H. Willans. Introducing the speaker, the chairman, Mr. A. McClements said that he had been an aircraft maintenance engineer for 20 years and, since 1951, had been works manager of the B.E.A. Helicopter Unit at Gatwick.

Mr. Willans prefaced his remarks by refuting any possible impression that he was biased in favour of American helicopters. He thought, in fact, that the Bristol 171, on the maintenance of which his comments were mainly based, was a better machine than all the others in most respects. That did not mean, however, that there was not room for improvement in certain details.

The golden rule in helicopter maintenance was, he thought, to leave well alone when a component was working satisfactorily. Trouble always seemed to follow when a unit was subjected to a routine examination to see whether it was functioning correctly. Sight, sound and feel were used to keep watch on the condition of working parts and he had never known of a working-part failure which had given no warning of its condition.

Fatigue, on the other hand, was a different matter, and was entirely a designer's problem and responsibility. There was nothing the maintenance engineer could do about it other than to realize which parts were subjected to a stress reversal whilst working and keep an eye on them for cracks. Most fatigue failures seemed to occur in non-working parts where it was not appreciated that stress reversals were taking place before it was too late.

The B.E.A. maintenance schedules were based on five inspection periods: Check 1, daily; 2, at 42 hr; 3, at 125 hr; 4, at 250 hr; 5, at 500 hr.

Check 4 was the one on which the serviceability of the machine was based. At this period all the inspection panels and cowlings were removed and the helicopter was examined in detail throughout. An extensive programme of work was not necessarily called for. It was an examination to ensure a further 250 hours of trouble-free running but it seldom happened that there was nothing to be attended to.

Another side to the maintenance schedule was that associated with the overhaul requirements. Certain components with internal working parts could not be classified as serviceable by an external examination and so the schedules listed all these items and defined the times at which they should be removed from the helicopter for a complete strip down. The overhaul of these units was the most expensive part of the maintenance of a complete helicopter.

Using figures for the Bristol 171, there would be approximately 3,800 man-hours expended on the maintenance checks per year, at the rate of a 2,000 hour/year utilization per aircraft. The average so far obtained with these helicopters for total labour requirements was 12 man-hours per flying hour and so on this basis the total requirement for the year would be 24,000 man-hours. Since, out of this total, 3,800 man-hours would be taken up with the maintenance checks, it followed that the component overhauls would require 20,200 man-hours, or more than five times the maintenance requirement. These figures were based on the low overhaul life (250 hours) for most of the components and showed clearly the urgent need for increasing this life. There was no reason why it should not be done, judging by the condition of the components when examined.

There was little complaint to make with regard to accessibility and ease of removal from the airframe but there were many details where improvements could be effected. As far as gear boxes were concerned, the American method of using ball bearings and ball thrust races allowed a far simpler re-assembly after overhaul than did the British tapered roller races. Also, the American peel-off shims were better than the British solid steel shims which had to be ground down to size each time after an elaborate fitting process.

Obtaining the correct fits and clearances could be an expensive job as far as man-hours and equipment required were concerned and this point had been badly neglected in some helicopter designs.

The lecturer continued on the question of rotor blades. There was a marked difference between the standards of finish in the American and British designs of both main and tail rotor blades, the American finish being superior. In some cases, the thin surface finish on British blades led to severe tracking troubles owing to moisture penetration. There was one type of British metal blade in service, but it had not been in use for long enough to make comparisons. The need for tracking the main rotor had to be avoided entirely if the helicopter was ever to become an economic commercial vehicle. It absorbed an enormous quantity of man-hours and none of the methods in use was completely satisfactory. The life of tail rotor bearings was too low and means should be provided to adjust the track of tail rotors, which were a constant source of vibration.

The airframe structure had never given any trouble on either the American or British designs but far more attention should be paid by the designer to the fitting of doors and their locks to ensure that they were proof against draughts and rain. This was a problem not confined to rotating-wing aircraft but it demanded more attention than in fixed-wing machines because of the increased vibration level.

The undercarriage and wheel brakes had not given rise to any significant problems, and maintenance of these units could probably be considerably reduced without affecting safety. The rotor brake, on the other hand, was a most important item as it was necessary to be able to stop the rotor quickly for the sake of passenger safety and to prevent blade "sailing" in a high wind. For this purpose the rotor-brakes so far provided had been a complete failure. They were too small and subject to constant unserviceability. There was now, for the first time, a rotor brake of American design which might prove adequate but B.E.A. had not had it in service for long enough to be certain.

Fuel and hydraulic systems could be said to be identical with those in fixed-wing aircraft from a maintenance point of view and no special troubles peculiar to helicopters had been experienced. It might be expected, however, that leaks and broken pipes in the hydraulic system would be intensified, owing to vibration, unless great attention was paid to proper support for all parts of the system.

Instruments gave no more trouble in helicopters than they did in fixed-wing aircraft, but they could well be more reliable. The specifications used to manufacture and overhaul instruments made no allowance for helicopter vibrations and, since the instrument panels in which they are mounted could not be brought within the fixed-wing standards of vibration, there was a gap between the two which spelt unreliability. This gap could not be closed by the maintenance engineer.

Mr. Willans concluded by saying that careful planning could reduce or vary the elapsed time required for a machine to be "off service" in order to carry out the maintenance schedule. The whole check could be done at the time it became due, or daily checks could be carried out with parts of all the other checks added each day, so that the whole of a major check was completed within the prescribed period. This latter practice, progressive maintenance, had its advantages but had to be employed with care and experience, and then only as a necessity. Local conditions had a major influence on the way in which schedules were followed but if progressive maintenance was over-done it could lead to an uneconomical use of man-hours and, therefore, a higher maintenance cost.

The Discussion

F. L. Swain (Westland) did not agree with the lecturer's statements on component lives. His company had had tail rotor gear boxes still in perfect condition after 600 hours' service and main rotor gear boxes after 480-500 hours. On the question of tracking, he said that they had known their metal bladed rotors to keep perfect track for as long as 400 hours without adjustment in certain cases. Servicing could be made easier by using the unit replacement system.

G. E. Walker (Bristol) agreed that the lecturer's policy of leaving well alone was a good one where it could be applied. The number of 250-hour inspections carried out on Bristol 171s was small by comparison with the experience on American helicopters but his company thought that the experience so far obtained was sufficient to justify increasing the overhaul life of certain components to 500 hours in the near future. He thought that tapered roller bearings were the most suitable for the application and said they were now almost universally used in motor-car wheel hubs and differential gears. He agreed that the tail rotor bearing life was low, but these components were inexpensive items which were easy to replace. He had not previously heard of any necessity to track tail rotor blades.

E. Voss (Bristol) said that 400 hours was the present military overhaul life for all components throughout the transmission system of the 171 helicopter and he also thought that the lecturer's man-hour figures for overhaul times were too high. 500 man-hours should be ample for a complete transmission overhaul. The solid steel shims should only need grinding after 1,500-2,000 hours. Their correct fit was a good indication that the gear box

MAINTENANCE OF HELICOPTERS . . .

had been re-assembled properly. They had had little trouble at Bristol with blade tracking, for which they always used the "cat's eyes" method.

S/L. G. C. Matthews (Air Eng. Branch, R.A.F.) said that experience in the R.A.F. had been similar to B.E.A.'s but different solutions had been found. Overseas maintenance had to be done in the open but serviceability had been maintained in spite of torrential rain and hot sunshine. He asked whether the time was not approaching when a re-examination of the necessity for crack detection should be made. Better accessibility was a feature to which he felt designers should pay more attention. He would like to see a helicopter in which unit replacements for a complete overhaul could be effected in 24 hours.

Lt-Cdr. M. Hayward (R.N.A.S. Gosport) considered that tracking was an essential feature of naval operation, owing to the need for rotor blade folding aflost. They could track a rotor in ten minutes using the flag method. He paid a tribute to the ruggedness of helicopters. On one occasion, a broken hoist wire had sliced 6-8 feet from the tip of one of their blades while hovering over a ship but the machine had been able to fly back to its base successfully, a distance of 28 miles.

J. Leason (B.E.A.) thanked the Helicopter Association for the invitation to S.L.A.E. members. He thought that the stage for adopting the "leave well alone" policy had not yet been reached. He proposed the use of ultra-sonic or X-ray equipment to attempt to anticipate the detection of fatigue cracks before the actual crack occurred.

W. Gibson (British Timken) thought the lecturer had dealt unfairly with the question of tapered roller bearings. Their bearing life expectancy was higher than that of ball bearings and thrust races and they were used exclusively in British helicopter designs as well as in some notable American designs.

J. Shapiro (consultant) agreed with the principle of leaving well alone but said that wear in moving parts could result in a redistribution of load and it was up to the maintenance engineer to keep a close watch on this and prevent fatigue from having serious results.

G. Newbery (M.o.S.) was of the opinion that fatigue was not entirely the designers' responsibility. When a component was tested for fatigue limits, the results only held good whilst that component was operating under the same conditions as in the test. In the actual machine, the conditions deteriorated. In addition, corrosion could produce severe stress concentrations; it was the duty of the maintenance engineer to watch this. He was interested in the proposal to use X-ray equipment to detect weaknesses but, so far, nobody had succeeded in devising a satisfactory method of doing so.

I. Chichester-Miles (Hunting-Percival) asked what proportion of the passenger fare was absorbed in maintenance costs.

R. H. Whitby (B.E.A.), replying on the lecturer's behalf, stated that the proportion was approximately 2d out of every shilling.

Mr. Willans, in reply to the discussion, said B.E.A. could not use the naval methods of tracking satisfactorily, nor would the A.R.B. allow them to work on the 400 hours' military overhaul life for transmission components. He stood by his own man-hour figures for overhauls as being more realistic than those quoted by Mr. Voss.

PUBLICIZING NATO AIMS

AN extensive advertising campaign in European newspapers as means of helping to explain the aims of NATO has been embarked upon by United Aircraft Corporation. Full-page advertisements are being printed in 25 leading newspapers in 13 countries.

Mr. H. M. Horner, the company's president, has said that he hopes the series will help to build popular support for the policy of collective defence against aggression; stress the war-prevention possibilities of NATO; and offer convincing evidence of the sincerity of American participation. The advertisements have no direct connection between United Aircraft and the issues discussed.

THIRSTY WORK

A "BASE RECORD," and possibly a record for the U.S.A.F.'s 2nd Air Force, has been set up by Boeing KC-97 tankers of the 2nd Air Refuelling Squadron at Hunter Air Force Base, Georgia. The KC-97s transferred more fuel to B-47 Stratojets during January than, it is stated, "the average filling station would pump in three years." A total of 563,270 U.S. gallons was transferred in sixteen flying days. One crew alone transferred 56,600 U.S. gallons in a one-month period. Since its inception four years ago, the 2nd Air Refuelling Squadron has transferred more than six million U.S. gallons of fuel—two million from KB-29s and four million from the more efficient KC-97s, which were received during November 1953.

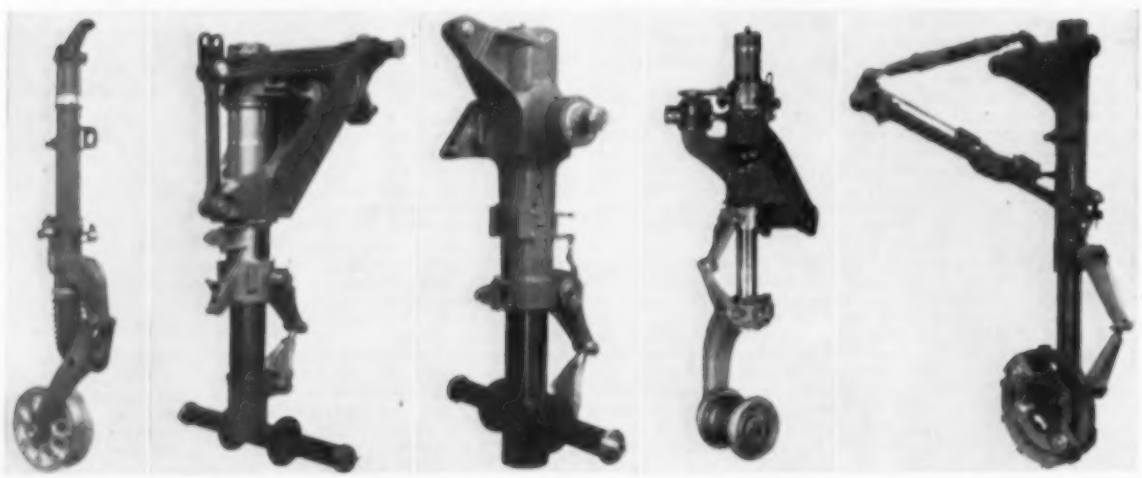
LANDING-GEAR BY HISPANO

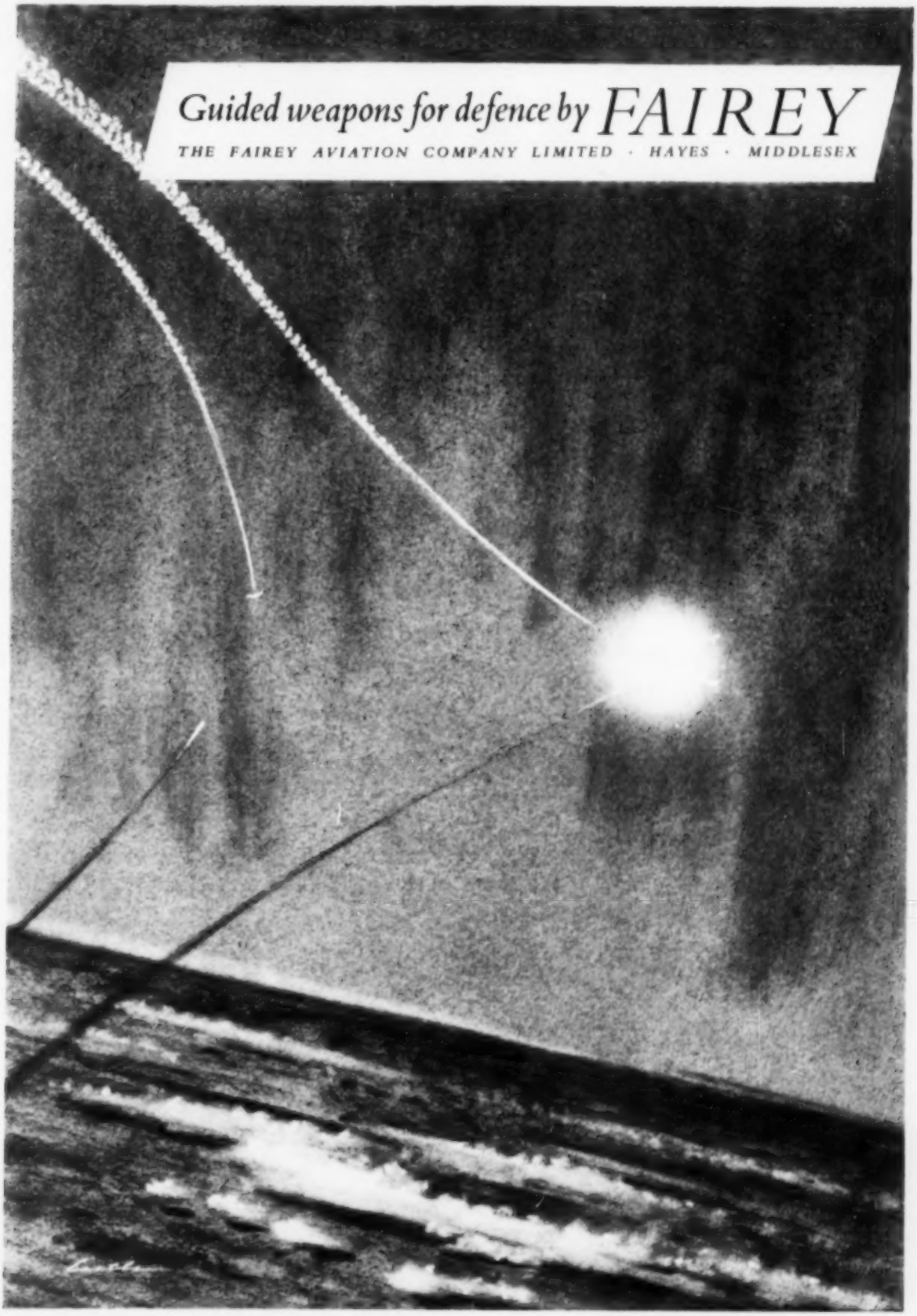
IT is not generally known in this country that the great international Hispano Suiza group make many things besides armaments and turbojets. Typical examples of their airframe accessories are the two sets of undercarriage legs illustrated here. Both sets are in full production, the manufacturing methods being very similar to those employed in this country.

Initial forging or casting is carried out to limits very near the finished dimensions, and high-strength light alloy is used throughout. The undercarriage units for the Vautour are made in Hiduminium RR-58 and those of the Fouga Magister (and for the SE-210 Caravelle) in Zicral (AZ 5 GU). The legs have oleo-pneumatic cylinders incorporating a diaphragm with variable characteristics.

Hispano supply the units complete with mounting, wheels, brakes and the associated hydraulic piping. The brakes, which are of the disc type on the units shown (not yet fitted to the Vautour units illustrated), are made under licence from Dunlop. Maxaret units are also made under a similar licence.

Five undercarriage units now being produced by Hispano Suiza. From left to right: the outrigger unit for the S.O.4050 Vautour (70 Vautours are on order), the steerable forward unit of the Vautour "bicycle," the rear Vautour unit, the nose undercarriage of the Fouga CM.170R Magister (100 of these aircraft are on order) and the Magister main unit.




Guided weapons for defence by FAIREY
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12th January, 1955.

ROCKET ENGINE TECHNICAL CERTIFICATE

No.1

This is to certify that the DE HAVILLAND SUPER SPRITE Mk.101 Rocket Engine No. R.114 - M.R.19 satisfactorily completed between the 21st September and the 14th October, 1954, a TYPE APPROVAL TEST to the requirements of the Ministry of Supply Rocket Engine Test Schedule. This is the first liquid propellent rocket engine to pass a Service Type Test for aircraft take-off assistance.

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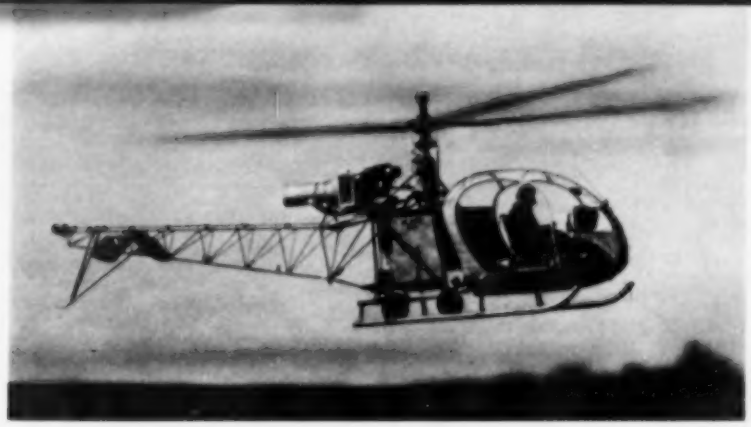
Middlesex.

1945 *First* military jet engine type approval (Goblin)

1948 *First* civil jet engine type approval (Ghost)

1955 *First* liquid rocket engine type approval (Super Sprite)

See classified advertisement for technical staff vacancies



Yet another French turbine-driven helicopter is the S.E.3130 Alouette II, which entered the free-flight stage of its trials on Sunday, March 13th. Powered by a 360 h.p. shaft-drive Turboméca Artouste II, the Alouette II can seat five and is designed to cruise at better than 100 m.p.h. for 320 miles.

AIRCRAFT INTELLIGENCE

Great Britain

Bristol high-speed research aircraft. A French journal reports that the Bristol Aeroplane company are building an experimental aircraft intended to reach a Mach number of 2.2. This machine, it is stated, will be powered by a turbojet and will have "une aile droite" (straight wing).

V-bombers. Recent statements published in America include the following: Valiant production is about two aircraft per month; this aircraft "still suffers from undesirable tail vibrations under certain conditions"; the Vulcan "has flown at Mach 0.97 at 60,000ft"; that "a thin-wing version with podded engines is supposed to be under development"; and that the Victor "is thought of more as advanced aerodynamic testbed rather than as a near-term potential atom bomber."

New Fighter. It is stated in America that "one of the next [British] prototype fighters will employ reverse camber in its wings (making them concave in part rather than convex as they are now), beginning the era of blown or suction ducted boundary layer control, with all its advantages of high lift, low drag."

U.S.A.

Martin SeaMaster. The drawing below, believed to be the first accurate representation yet published outside the U.S.A., shows the tremendous length of hull. A considerable amount of titanium and stainless steel is used in this fast minelayer and patrol machine, the unpainted anodized shrouds over the afterburners being prominent. Production machines, which are expected next year, will have a search radar in the nose faired by a radome more pointed than that used on the Marlin (this page, last week).

North American F-86F. This familiar Sabre variant, which went out of production in May, 1954, is reported to have been re-ordered to the extent of $5m (£1.8m), "primarily for NATO".

Tubeless tyres. Already familiar to American car-owners, tubeless tyres are being introduced to military service in two fighters of the U.S. Navy, the North American FJ-4 Fury and the Grumman F9F-9 Tiger. Both these aircraft have a tyre pressure considerably greater than 200 lb/sq in.

Radioplane YQ-1B. Now under active development by this well-known maker of radio-controlled target aircraft (the firm is a subsidiary of Northrop), the YQ-1B is the first announced application of the Rolls-Royce Soar turbojet (presumably the Soars will be supplied from Great Britain). It has an unswept wing of 14ft 3in span and a fuselage rather more than 17ft long, with a direct pitot intake at one end and a twin-finned tail at the other. Speed appears to be subsonic.

Canada

Avro Aircraft CF-105. According to *Aviation Week*, "Avro Aircraft is tooling up for the new delta-wing intercepter C-105. Two prototypes have been ordered by the Canadian Government. First is expected to be ready this year, with production scheduled for 1960. The plane will use Pratt & Whitney J57 jets in the prototype, while production models are slated to get the Avro Super Orenda PS13. The C-105 is designed to have a speed of 1,200 m.p.h., range of 1,500 miles. Its armament is to include Canadian-developed Velvet Glove guided missiles."

D.H.C.3 Otter. The 84 machines being supplied to the U.S. Army will not now be styled C-137; instead they fall into the "liaison" category, and will probably be known as the L-27. Now, the U.S. Navy are buying four, with the designation UC-1, for use in an expedition to the Antarctic. They are likely to be delivered with "universal" wheel/float/ski undercarriages.

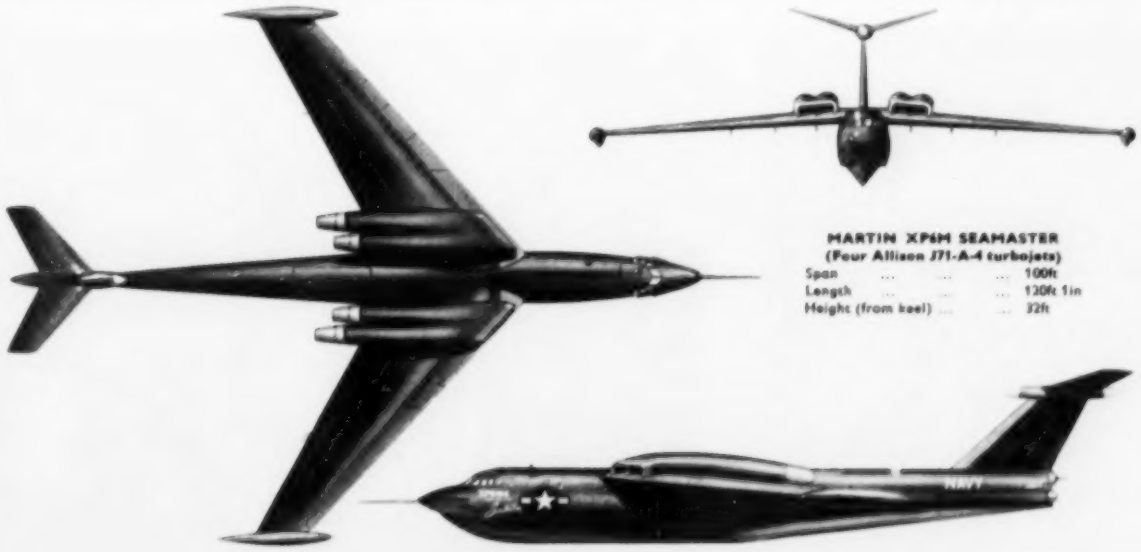
D.H.C. Sentinel. It is expected that the Grumman CS2F anti-submarine aircraft now going into production in Canada will be built in at least two versions. In America the basic Grumman design is used as an A.S.W. search-strike aircraft (S2F-1), as an early warner (S2F-2), as a trainer (TF-1) and as a general utility transport. The S2F-2 carries a large radome under the forward fuselage, housing an APS-20 scanner; the shorter-wave scanner of the S2F-1 is mounted, Gannet-fashion, in a retractable dustbin aft.

France

Nord 2520. Next August is the month scheduled for the first flight of this development of the Hercules-powered Nord 2501 Noratlas twin-boom transport. Powered by 2,400 h.p. Pratt & Whitney R-2800 CB-17 engines, the 2520 should be able to take a payload exceeding 17,000 lb. It is hoped that, owing to the fact that many French-owned airliners use the R-2800 engine, the 2520 will find a civil market. The independent operator U.A.T. already has two 2501's (picture, *Flight* of February 18th last).

Czechoslovakia

Modified Sokol. Scheduled for delivery to Milan next month is I-VARI, a revised version of the well-known Sokol three/four-seat touring aircraft originally of Benes Mraz design. The undercarriage of the new Sokol is of what is termed "reversed tricycle" type, i.e. the main wheels are mounted well forward below the wing and the third wheel is a full-size unit mounted on a nosewheel-type leg just aft of the trailing edge of the wing. On the ground the new Sokol remains in flying attitude.



MARTIN XP6M SEAMASTER
(Four Allison J71-A-4 turbojets)

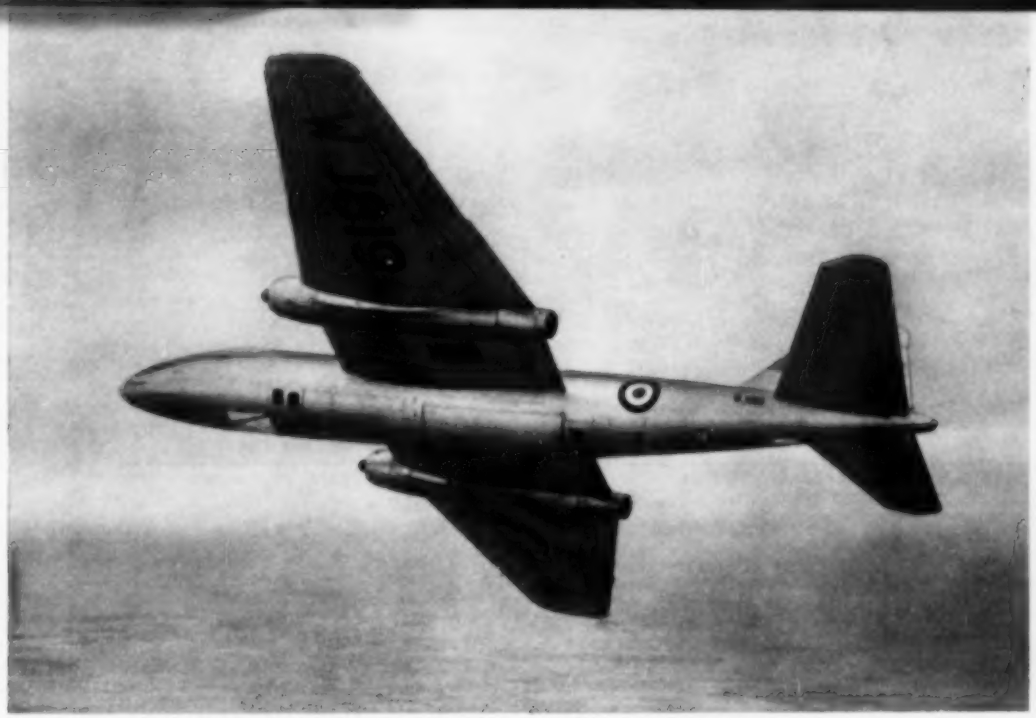
Span	100ft
Length	130ft 1in
Height (from keel)	32ft

(Left) F/L. Coleman (right) briefs F/Ls Black and Clerbaut before a Canberra P.R. sortie. (Right) Detailed briefing from F/O. Harris.

TERRESTRIAL AND

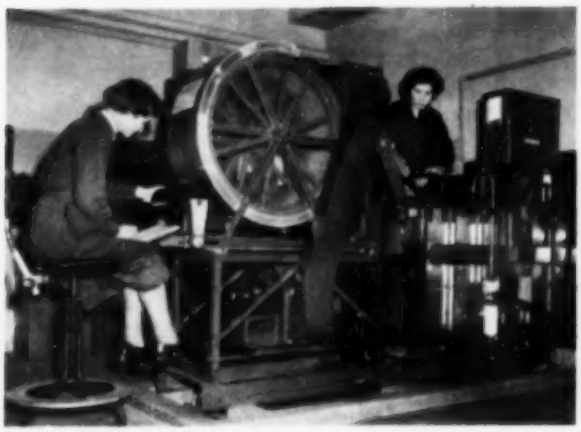
FOR the arduous and exacting duty of high-altitude photographic reconnaissance the Royal Air Force depends upon its squadrons of English Electric Canberras (Mks P.R.3 and P.R.7) and Meteor P.R.10s—all capable of operating at heights in excess of 40,000ft. Lately secured at R.A.F. Station Wyton, Hunts., the pictures on these pages are illustrative of the work of a typical P.R. unit, and are, at the same time, a reminder that the skill of the pilots and navigators, and the qualities of the aircraft, can be translated into usable intelligence only with the backing of specialist ground trades. The pictures, too, evoke the reflection that reconnaissance was the first duty which fell to the Royal Flying Corps in World War I. During the course of that war various types of aircraft, notably fast day bombers, were adapted for the work, and this continued to be so in the years before World War II. Early in that war, however, it was realized that fighter-like performance was demanded, and Spitfires and other types were hastily adapted. Later, special variants of the Mosquito, carrying up to seven cameras, were developed. Today the Canberra P.R.7 is the latest type in general employment, but the Service looks forward to—and assuredly deserves—special versions of the V-bombers, capable of flying at speeds in excess of 550 m.p.h., at heights above 50,000ft and over vastly longer ranges.

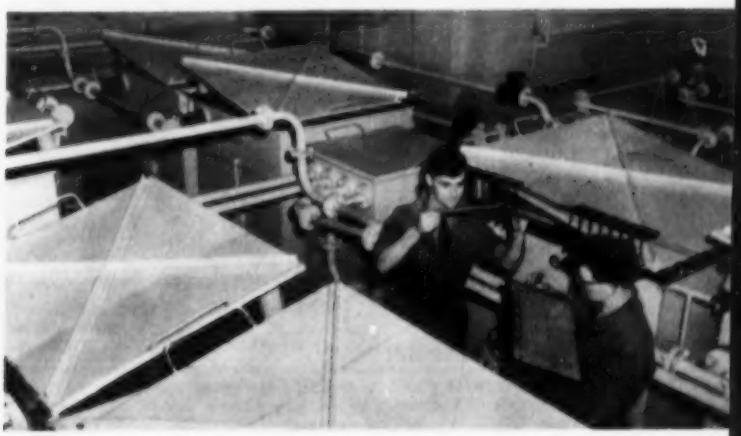
(Above, left) F/L. Black, navigator, demonstrates the use of his camera sight. (Below, left) S. A/C. Garrod plots on the map the area covered by two "split-vertical" prints. (Below, right) Loading F.52 cameras, with 36in lens, into a P.R. Canberra.



A Canberra P.R.7 (two Rolls-Royce Avon turbojets) banks obligingly to display its multiple camera ports.

AERIAL ASPECTS OF "PHOTO RECCE"





(Above, left) Film processing by L. A/C.W.s Godfrey and White. (Above, right) A temperature check on the hypo recirculators. (Lower left) L. A/C.W. Shipway trims prints. (Lower right) S. A/C.W. Downs stops down the iris diaphragm of a de Vere enlarger.

A North American B-45 Tornado at readiness at its dispersal.

47th Bombardment Wing (Light)

History and Equipment of the American B-45 Bomber Unit Based in Norfolk

AMONG a number of American Air Force units based in this country is one whose presence has so far received little publicity, despite the fact that it is still, three years after its arrival here, the only four-jet bomber unit to be operational in England. It is the 47th Bombardment Wing (Light), whose three squadrons of North American B-45s Tornadoes are based at Sculthorpe, Norfolk, together with the headquarters of the parent formation, the 49th Air Division. The division's other wings, also in East Anglia, are at present completing conversion to Republic F-84Fs.

Flight recently obtained permission to visit the wing at its base, and went there expecting to find a carefully organized unit concentrating a great deal of care and technical knowledge on the operation of a large jet bomber. The organization and the technical knowledge were everywhere in evidence and unequalled in quality, but the large jet bomber was not such a complicated mystery as some people had suggested. It has, in fact, been in service with the wing for no less than six years; it is well known and liked; and, but for the fact that it is powered by four jet engines, it is entirely conventional in handling.

At Sculthorpe, the wing has set up a complete township of its own, on the same pattern as a comparable R.A.F. bomber station but on a larger scale. To a certain extent, the American community shares in the day-to-day affairs of the countryside. (It may not be realized that during the great floods of early 1953 about a dozen American Servicemen and civilians lost their lives. The station personnel characteristically organized rescue services in the area, and one of them, Sgt. Leeming, was awarded the George Cross in recognition of his gallant efforts.)

Incidentally, a series of sonic booms, which may originate from aircraft of the neighbouring Central Fighter Establishment at West Raynham, have been blamed on the U.S.A.F., and it appears that some trouble has been experienced in convincing local inhabitants that the B-45 is in no way capable of such performance. Even while speaking to the C.O., *Flight's* representatives were soundly shaken by a splendid double boom, and were assured that a complaint could be expected to follow at Sculthorpe rather than at West Raynham.

The 47th Wing is organized on the wing-base pattern evolved after World War 2, so that the base is run by the unit which operates there. The commander of the wing, Col. D. M. Jones, is therefore also in charge of the base, and all ground units are an integral part of the wing organization. Deputy to Col. Jones is Col. J. Glover, and both are supported by the wing staff. The position equivalent to that of wing commander, flying, at an R.A.F. station is that of deputy for operations, Col. G. B. Price.

Three groups directly responsible to these are the flying wing, the maintenance and supply group and the base personnel group. The bomber squadrons themselves are the 84th (Lt-Col. R. L. Fitzgerald), the 85th (Maj. R. E. Grover) and the 86th (Lt-Col. E. Miller). Their aircraft are respectively distinguished by red, yellow and blue diagonal flashes on the fins and rudders.

The operational strength of the wing is between 40 and 50 aircraft, each squadron having in addition two Lockheed T-33As for instrument training. There are also a number of transport aircraft on the station, including some Fairchild C-119Gs, a

Colonel D. M. Jones, commander of the 47th Bombardment Wing with, left, his deputy for operations, Colonel G. B. Price.

B-26 target tugs which operate from Sculthorpe for the benefit of fighter/ bomber squadrons.

Illustrated with "FLIGHT" photographs

D.H.C. Beaver, and a number of the faithful old "Goony Birds," as the U.S.A.F. calls its Dakotas. Also in evidence during our visit were some venerable B-26 target tugs (the bomber version used to form the wing's main equipment), which operate for the benefit of the American fighter bombers. Also at Sculthorpe are the RB-45Cs of the 19th Reconnaissance Squadron, a lodger unit at the base, and one which naturally keeps its own counsel.

The 47th Bombardment Wing has a distinguished history dating back to the days of the fighting in Tunisia and, but for one short period of "de-activation" it has existed as a unit for 14 years. Its standard proudly bears two Presidential unit citations for distinguished service, gained during the fighting in the Po Valley and in North Africa. Among its many campaigns it numbers Morocco, Tunisia, Sicily, Naples-Foggia, Rome-Arno, North Apennines, Po Valley and Southern France.

The wing was formed on January 15th, 1941, as the 47th Bombardment Group at McChord Field, Tacoma, Washington. The group had four squadrons, the 84th, 85th, 86th and 97th and, when they joined the 2nd U.S. Air Force on the American west coast in August, each squadron had two Douglas B-18s (called Digbys by the R.A.F.) and two PT-19 trainers. Some Douglas B-23s were also due, but events moved slowly until the Japanese struck at Pearl Harbour in December that year. Immediately the 85th took over all the group's B-18s and the 97th received B-24s and LB-30s and both units began to patrol the Pacific in search of Japanese submarines. But in January, 1942 the whole group was equipped with Douglas A-20 attack bombers and began working up for their ground-attack role.

In July newer versions of the A-20 arrived, together with B-20s, and the group took part in exercises in Carolina preparatory to sailing for England. It was after the advance units had been established here—near Bury St. Edmunds—that the ground personnel following them were diverted to North Africa. There they took up rifles and fought alongside the infantry before setting up base at Medina. By November the whole group was once more assembled and the squadrons dispersed at Thelea and Youks-les-Bains. It was here that the 86th flew the group's first operational sortie. Then, between February 15th and 19th, 1943, while the battle of the Kasserine Pass raged, the group flew one sortie every seven minutes until the advance of enemy ground troops forced them to withdraw from their bases and concentrate, on February 25th, at Canrobert.

In April the unit's role was changed to medium-altitude bombing from a new base at Souk-el-Arba, and from here they operated until early June when they moved to the neighbourhood of Tunis and began the bombing of Lampedusa and neighbouring islands.

Typically misleading as to the extent of their capacity are these drop tanks which in fact each hold 500 U.S. gallons.

For the invasion of Sicily the group operated from Malta and moved to an advanced base on the Italian island only three days after the initial landings. Then, on September 2nd, 1943, the formation moved to Taranto and became the first allied bomber unit to operate on the European continent. Following the advance on the ground, bases were taken at Foggia and Naples (which latter place the group had to evacuate during an eruption of Vesuvius), and on to Grosseto. It was from here that the first night intruder sorties were flown and, incidentally, led by 2nd Lt. H. J. McGee, who only recently left the wing at Sculthorpe, with the rank of major, after serving with it continuously almost since its foundation.

By now the group was operating from Corsica and, to assist the invasion of Southern France, Lt. McGee led a raid on the German H.Q. Co-ordinated with a paratroop attack, the operation was

Less familiar variant of the Tornado operated by the three bomber squadrons is this RB-45C—one of several belonging to the 19th Reconnaissance Squadron which lodges at Sculthorpe.

These superb aerial studies and the two reproduced overleaf are the work of "Flight" photographer, L. W. McLaren. They depict a skilfully flown four-jet B-45 of the American 47th Bombardment Wing (Light) stationed in Norfolk. The photographic aircraft was a T-33.

47th BOMBARDMENT WING (LIGHT) . . .

credited with the disorganization of the whole German effort in the area.

By now the group had a range of experience and achievement of which they could be proud, but their next assignment must have come as something of a shock. They were detailed to act as advanced transports to bring fuel and munitions to the P-47 Thunderbolt wings which had moved forward so fast that they had outrun their supply lines. This was the group's last effort with their now well-worn A-20s, and they moved back to Grosseto in late September to take over the new A-26 (since renamed B-26). Concentrating now solely on night intruder work, they waged their last European campaign with round-the-clock sorties in the Po Valley.

VE-day came on May 8th, and six weeks later the group returned to Seymour Johnson Field, North Carolina, where they were to undergo a 30-day training course before taking their A-26s to Okinawa. VJ-day, in its turn, however, forestalled this move and the long process of post-war run-down began.

Commanding officers changed frequently and first the 97th Squadron departed and then, in 1949, the 86th; and finally the group was "inactivated." The U.S.A.F. became an independent force and the whole structure of the Service began to change. Under the economy programmes many units were disbanded, but nevertheless in March, 1949 the 84th and 85th Squadrons were equipped with the North American B-45. But the running-down process continued, and the wing (as it had by then come to be reclassified) was disbanded and the two squadrons went to the 363rd Tactical Reconnaissance Wing at Langley A.F.B.

Then, on March 12th, 1951, the 47th Wing was re-formed and its two squadrons returned to it. A year later, under the command of Col. D. M. Jones, the 47th moved once again to England, this time without a hitch, and took up the base at Sculthorpe which they have retained ever since. A third of the original four squadrons, the 86th, came to Sculthorpe to rejoin the wing in late 1953.

The wing's flying equipment, the North American B-45 Tornado, is a remarkable aircraft. It has a performance and characteristics in many ways resembling those of the Meteor Mk 8 (with the notable exception that it has far better aileron control), yet in its bomber version it has a normal all-up weight of 85,000 lb and a maximum permissible weight of 110,000 lb. It has many of the refinements one has come to expect of the American fighter of the F-84G type, and a bomb-bay designed to accommodate a 22,000-lb bomb. Though an aging aircraft, born during the period of most stringent economy of U.S.A.F. equipment, it carries a complete radar bombing system and a tail turret mounting two 0.50in guns with a radar-ranging gunsight.

The B-45 has a pressurization differential of 6.5 lb (12,000ft cabin altitude at 40,000ft) in the two crew compartments, nose and tail, an excellent air-conditioning and

"FLIGHT" photographs

heating system and boosted controls for all three axes. Antedating the fashion for bogie undercarriages, it has very large single main wheels with hydraulically operated, segmented disc brakes. The engines are four General Electric J-47s of 5,200 lb thrust each.

With all this the B-45 is by all accounts a completely straightforward aircraft to fly. It is light and viceless, has a good ceiling even at full load, and a top speed which is high considering its date of design. It carries a very good load, now mostly composed of fuel, and can remain airborne for four-and-a-half hours. Pilots remark that it is only slightly sensitive to increased load and that even an overload take-off with the two under-nacelle 500-gallon external tanks fitted is no more difficult, and not much longer, than a normal one.

The average length of the "missions" flown by the squadrons is 3 hr 15 min, but whatever the task the fuel load is apportioned so that, ideally, the aircraft will always land with the same reserve. The wing's operational commitments would entail mainly single-aircraft raids, presumably making use of "atomic capability" in high-level support of ground forces. The radius of action is not published, but it is in the region of 500 to 700 miles. The B-45 cannot be air-refuelled; but, because of the lightness of the probable bomb load, the extra fuel tank mounted in the bomb-bay is now considered a permanent fixture, and extreme range must be considerable.

The aircraft carries a crew of four, two pilots in tandem under the canopy and a navigator/bombardier down in the nose, all

47th BOMBARDMENT WING (LIGHT) . . .

three in the forward pressurized compartment. The tail gunner sits in lonely state in his own compartment high up in the extreme tail. His position is also pressurized but, apart from intercommunication, completely isolated from the others. He reaches his place through a hatch under the fuselage, just aft of the bomb-bay, from which he climbs aft and seals himself into the turret. For the two pilots, escape is by ejector seat. The bombardier can extend a series of flaps ahead of the main access door. He then escapes normally after jettisoning the door. A similar system is provided for the rear gunner. He extends flaps under the tailplane, and escapes through a small square hatch just beneath the elevator. Oxygen is supplied for all the crew, but since the cabin differential is 6.5 lb it is not used until the "combat" setting of 2.5 lb is selected somewhere near the target.

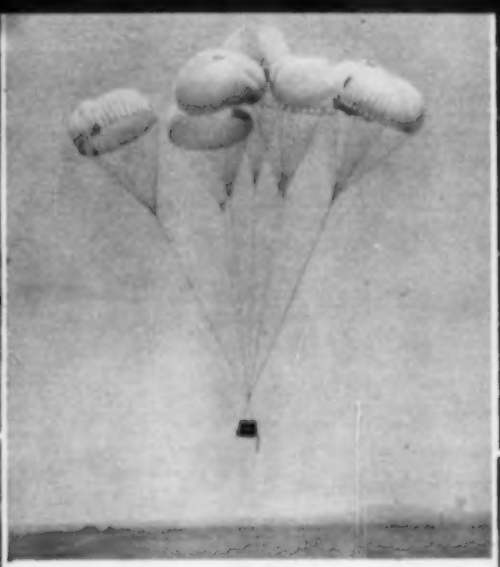
It was remarkable to see, during our visit, how the B-45 was handled. It is obviously extremely manœuvrable, and in the circuit it was the rule rather than the exception to apply about 45 deg of bank and perform almost a fighter-type approach. Landing speeds and distances appeared very moderate.

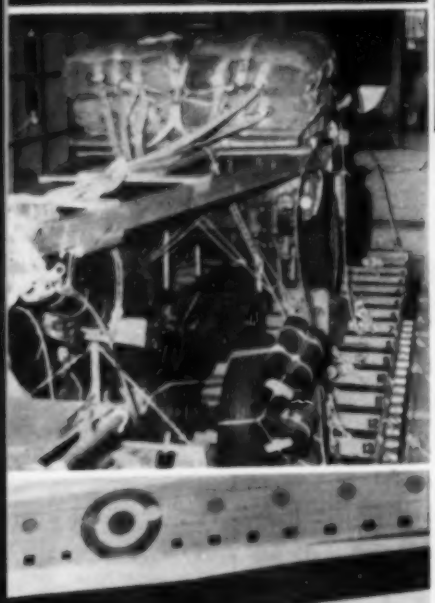
Those whom we met at Sculthorpe summed-up the B-45 as a steady and straightforward aircraft which had done a good job for a long time without causing trouble. It is regarded, in fact, as a large orthodox aeroplane which happens to be powered by four jet engines, and the advantage in smoothness and speed which these confer seems to be in no way outweighed by any vices or difficulties. It was added, however, that the comprehensive equipment, such as boosted controls, had to be paid for in extensive maintenance requirements.

When, finally, we asked about possible re-equipment—the B-57 Canberra or the B-66 being particularly in our minds—we found no ideas on the subject. For the time being at least the B-45 is to remain the third type that the wing has used in numbers since it was first formed in January, 1941. The squadrons are carrying on with the four-jet bomber they have flown for six years, without any great concern for what the future may hold in the way of new aircraft. Meanwhile, for three of those six years they have, in company with the other wings in the 49th Air Division, quietly provided NATO with a defensive potential which may well have been decisive in giving western Europe time to prepare for its own defence.

C.M.L.

The performance of the B-45 with four General Electric J47s is broadly comparable with that of the Meteor 8. The photographs above and below clearly reveal the squadron markings, the tail turret with its two 0.50in radar-laid guns, and the bomb doors which enclose a bay capable of accommodating a 22,000-lb store. Ceiling of the B-45 is over 45,000ft.





THE
SECRETARY OF STATE
FOR WAR

speaking in the debate
on the Army Estimates
on Tuesday 8th March,
1955.....

"..... the
Blackburn 'Beverley'.
This is probably the
best large Freighter
Aircraft in the world
to-day."

Blackburn and General Aircraft Limited. Brough, E. Yorks

The Viper powered Folland Midge fighter . . . .

The long life Viper has been type-tested and approved for production at 1640 lb. thrust

(Specified fuel consumption 1-09)

This engine has been specially stressed for all trainer applications

The Viper powered Percival Provost jet trainer

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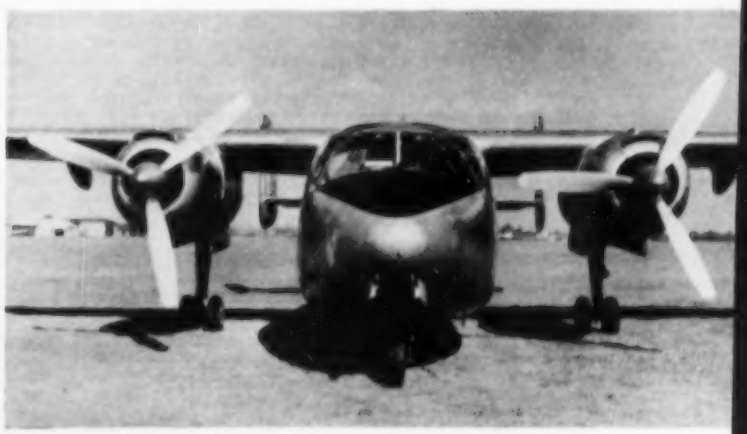
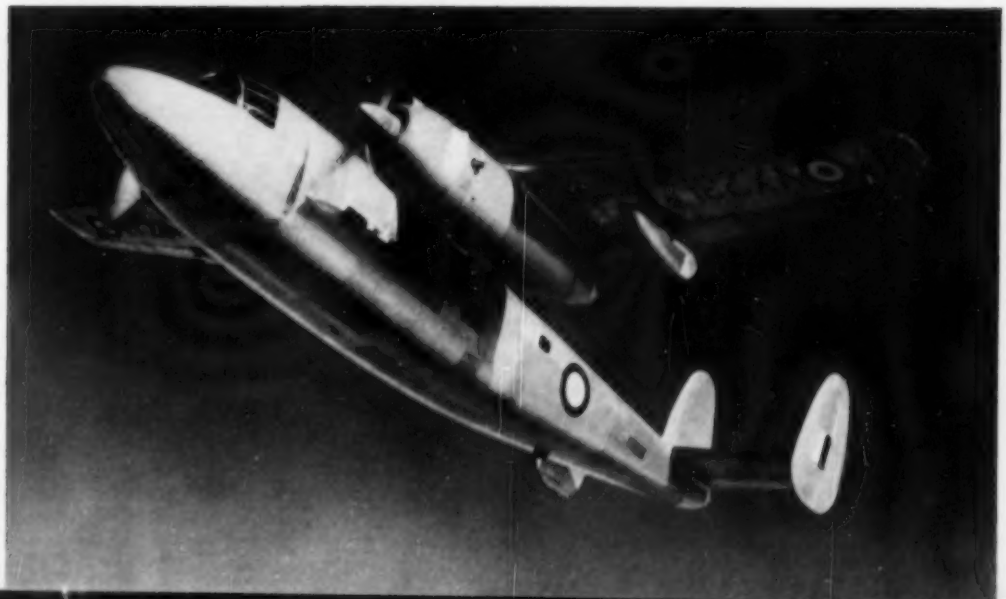
FIRST in-the-air pictures of the H.P.R.5 Leonides Major test-bed show it to be a pleasing, if conventional, machine. The Alvis 14-cylinder radials are neatly cowled (the panels are petal-opening) and give a preview of the Herald inboard nacelles with which they are identical. The engines are smooth and quiet and the exhaust is led out through a single stack on the outside of each nacelle. Early trials have indicated that the cooling arrangements are more than adequate for tropical work. The interior photograph shows the engine flight-observer's station, mainly concerned with temperature observations, and in the background the normal photographic recording set-up. Further details appear on page 376.

H.P.R.5

"FLIGHT" photographs



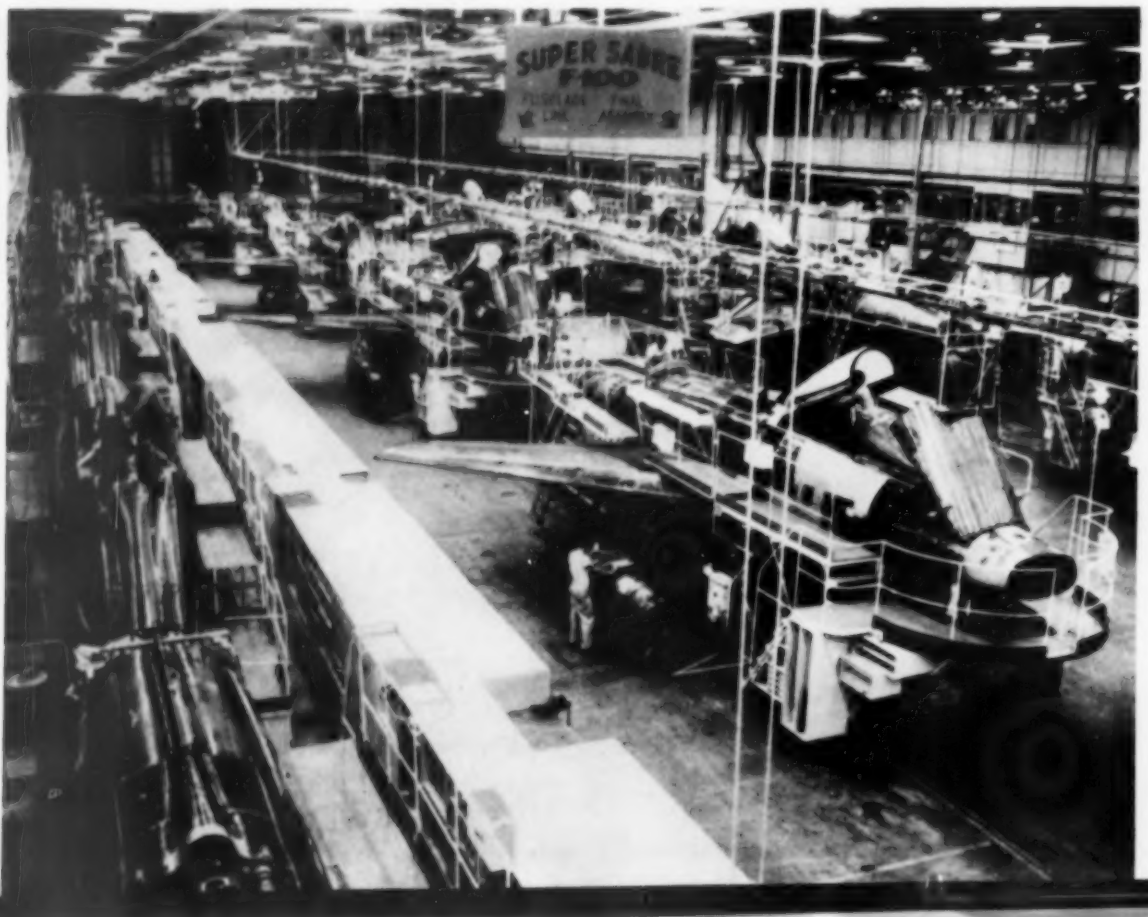


GATHERING MOMENTUM

Inside Four Big American Aircraft Factories: Newest Types in the Making

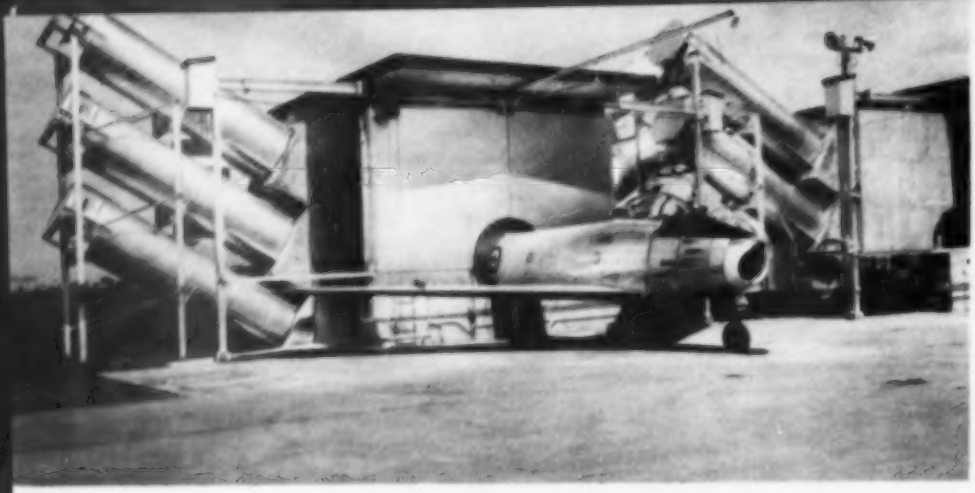
UNLIKE this country, America permits, as a matter of course, the publication of photographs showing the manufacture of her very latest types of military aircraft. It is therefore possible to show scenes in the manufacture of a 190-ton jet bomber, a Mach 1.4 fighter, a supersonic carrier fighter and a versatile tactical or strategic transport. The great aircraft above is a Boeing B-52B Stratofortress, completed by a recent night shift at the Seattle factory (8½ million square feet, nearly 40,000 employees). After passing through the pre-flight line (*Flight*, March 4th) and testing at Larson A.F.B., 140 miles to the east, it will be delivered to the U.S.A.F. Strategic Air Command. Points of interest are the anti-flash paint to protect the crew from atomic explosions, the folded fin and the open doors of the bomb bay—the latter being just big enough for the most potent weapon yet devised by man.

IN their 21 years of existence, North American Aviation, Inc., have made more aircraft than any other company—over 50,000, in fact—and most of them were built in the Los Angeles factory (4m sq ft, 26,000 employees), a corner of which is seen below. By far the greatest production effort at Los Angeles is now devoted to the F-100A Super Sabre, and one end of one set of assembly lines is illustrated. The F-100 airframe incorporates several hundred pounds of titanium alloy and a high proportion of the structure is integrally stiffened; North American have extensive experience of both techniques. The F-100 is propelled by a Pratt and Whitney J57-P-7 turbojet (14,500 lb thrust) which is inserted into the fuselage from the rear before the latter is lowered by crane on to the wing. The tailored "docks" are prominent, and with their aid it is possible to work at two levels at once.



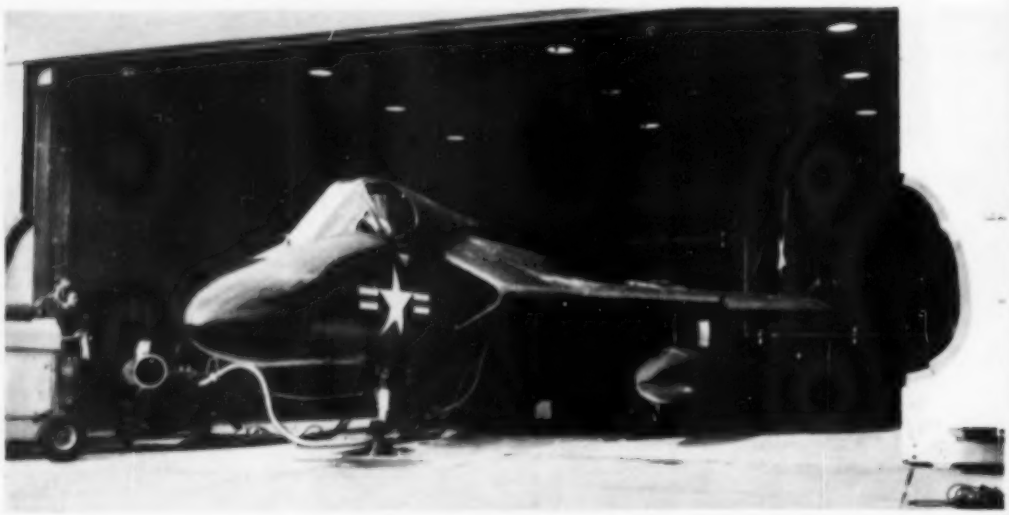
DURING World War II many enormous factories were constructed in all parts of the U.S.A. with public funds, for lease to various aircraft companies. One of these was GAP-6 (Government Aircraft Plant No. 6) situated just outside Marietta, Georgia. Unlike the majority of the government factories, GAP-6 remains today in full production of complete aircraft (4¼m sq ft, 15,000 employees). Leased by the Lockheed Aircraft Corporation, it has built hundreds of Boeing B-47E medium bombers and is now rapidly getting into its stride with the radical Lockheed C-130A Hercules transport, a 50-ton machine driven by Allison T56 turboprops and capable of lifting a 40,000-lb load. The photograph above shows the first Hercules line as it was earlier this month. Although much lighter than the plant's other product (in the background), the C-130 is larger, with a span of 132ft.

OF the four main divisions of the Douglas Aircraft Company, the largest is that at El Segundo, California (4¼m sq ft, 25,500 employees). El Segundo is responsible for all work on Douglas naval aircraft, and they recently delivered the 2,500th Skyraider —an "old faithful" which is still in full production. At present, the fastest aircraft built at El Segundo is the F4D-1 Skyray interceptor, a compact bat-winged machine which in 1953 established a world speed record of 752 m.p.h. and a 100km circuit record (which still stands) of 728 m.p.h. The F4D-1 is built on top of a trench from which all underside work is performed. In the photograph, the engines—afterburning J57-P-2s of 14,600 lb thrust—are being installed, and electronic units assembled. Search radar is mounted in the nose and four cannon are installed in the wing. A photograph of a completed F4D-1 appears on p. 396.



Supplied by the Maxim company, this type of running-up pen employs no fewer than six muffler units similar in conception to the British Detuner. The doors of the absorbent cell close tightly around the fuselage of the aircraft so that, although no personnel need be inside the cell during running, intake noise is unsuppressed. These installations are owned by Canadair, Ltd., at Montreal; the aircraft is an Orenda-powered Sabre, No. 1,082.

SUBDUED THUNDER



Basically similar to the installation above, this cell is also seen from outside, though the sliding doors are fully open. Owned by the Douglas Aircraft Company (El Segundo Division), the cell is one of several used for pre-flight running of production F4D-1 Skyrays. The Skyray nosewheel is sunk below floor level in order to get the efflux from the afterburning J57 in line with the outlet diffuser. In this case the doors fit tightly around the forward fuselage, and must impair the intake efficiency.

The Amazing MG-4

IT has just been disclosed that the fire-control system, designated MG-4 and installed on the North American F-86K intercepter, not only permits accurate firing of the 20 mm guns, but can be used as a navigational aid also. A number of F-86Ks with the equipment are being procured by the U.S.A.F. with M.D.A.P. funds, for delivery to NATO countries. The F-86K is in production not only by North American in Los Angeles, but by Fiat in Italy, and twelve students from Italy, Norway and France are studying the MG-4 before becoming NATO instructors.

The MG-4 is in production at North American's Downey plant and is said to provide the pilot with information which enables him to locate airborne targets, select a particular target, and fly an accurate "lead-pursuit" course which keeps his aircraft pointed slightly ahead of the target. It indicates the range of the target so that he can "determine the maximum firing range for his 20 mm guns," and the suggested "pull-out" time, at which point (in the words of a North American Press release) the pilot should initiate manœuvres to conclude the attack. In addition, the system is said to include "beacon interrogation and ground-mapping facilities" for use as navigational aids. When ground-beacon stations are interrogated a coded response is received, which is displayed on the pilot's radar scope. Interrogation is accomplished when the radar in the aircraft transmits a signal which "triggers" the beacon, causing it to respond according to its code. The pilot can then identify the beacon station and determine his position by reading the azimuth and range information on his radar scope. Group-map operation (again we quote North American) "provides navigational information by presenting a map-like pattern of the terrain on the radar scope. Cities, lakes, rivers, mountains and coastal areas are usually recognizable."

THE AERONAUTICAL BOOKSHELF

"Cheshire V.C.," by Russell Braddon. Evans Brothers, Ltd., Montague House, Russell Square, London, W.C.1. Illustrated. Price 12s 6d.

RUSSELL BRADDON took on a formidable task in attempting to write a biography of Leonard Cheshire; because the result could hardly be more than the loosely-linked stories of three entirely different men.

In the first 54 pages, we read of an irresponsible youth, living in a playboy world of dangerous cars, gorgeous blondes, hare-brained escapades and an unimpressive Second at Oxford. Only hint of the man to come was in his flying with the University Air Squadron, which he enjoyed without showing any signs of becoming a good pilot. Typically, he planned to utilize his newly acquired art in an attempt to fly the Atlantic in one of Alan Cobham's old biplanes, with the boilerman at Merton as navigator.

Little more than a year later, a vastly different Cheshire was in the Royal Air Force. The war gave him a motive for life and an authority to live under. Slowly, from the most unpromising material, grew the supremely efficient man of war, the much-decorated hero of a hundred bombing raids which, statistically, should have cost him his life four times over.

This part of the story, filling 87 pages, is superb. It could not fail to be; for Cheshire was great, even judged by the standards of No. 617 Squadron, which he took over from Guy Gibson. His steady development of the technique of target-marking, first in a Lancaster, then a Mosquito, and finally in a Mustang, did much to maintain the squadron's proud reputation for precision bombing. And his own reputation was such that he was chosen as one of the two Britons who witnessed the explosion of the atomic bomb over Nagasaki.

"I may as well confess," he said later, "that we were so keen on dropping this bomb, and would have been so disappointed if the war had ended without our doing so, that some of us jokingly suggested, if Japan *did* surrender before we flew to Nagasaki, that we might even fly there and drop the bomb just the same!" Yet it was in the holocaust over Nagasaki that the third Cheshire was born—a man so very different from Cheshire the undergraduate, or Cheshire the master bomber, that the last 74 pages of the book will have varying appeal to readers. It is hardly logical to expect a religious crusader who founds homes for the aged and chronically sick to have the same glamour (if the word may be forgiven) as a 27-year-old group captain with the Victoria Cross, three D.S.O.s and a D.F.C. Yet who can judge which is the greater?

"Fleet Air Arm," by Lt-Cdr. P. K. Kemp, R.N. (Retd.), F.R.Hist.S. Herbert Jenkins, Ltd., 3 Duke of York Street, London, S.W.1. Illustrated. Price 16s.

THIS history of the Fleet Air Arm by the Admiralty Archivist is intended for general readership; and every public library in the country ought not only to have a copy but to make sure that it is read by as many as possible of its borrowers. Very few people (least of all the leader-writers of sensationalist Sunday newspapers) seem to know anything about the past achievements of the Fleet Air Arm or its present capabilities. Cdr. Kemp's book will educate and entertain them simultaneously, because the exploits it recalls are among the most exciting and proud in the annals of war.

Keynotes of the history are courage, enterprise, economy of force and an aggressive spirit of attack, even in the face of certain death. Nowhere are these qualities more evident than in the well-known Taranto action of 1940 and the gallant sortie by Esmonde's little squadron of Swordfish against *Scharnhorst* and *Gneisenau* in 1942.

But there are many less well-known exploits which make equally exciting stories, such as the battles between R.N.A.S. flying-boats and German Zeppelins and U-boats in the 1914-18 War; Culley's victory over Zeppelin L.53 after he had flown his Camel fighter off a lighter in mid-Channel; the achievements of *Warspite's* Swordfish during the second Battle of Narvik in 1940; and of Hurricanes from the escort carrier *Avenger*, which helped to destroy over 40 enemy aircraft in two days whilst protecting Russia convoy P.Q.18 in 1942.

Cdr. Kemp's book will not, however, satisfy those who demand complete technical and historical accuracy. He gives a good general picture of the development of sea flying; but it is not true that Cdr. Schwann was the first man to fly a seaplane (p. 17), that Shorts built the first real seaplane (p. 18), that nobody had tried to construct a bomb-sight by 1912 (p. 20), that Naval pilots were the first to attempt to fit machine-guns to aeroplanes (p. 23), that few people thought it practicable to operate monoplanes from aircraft carriers in 1939 (p. 112), or that the Barracuda was of American origin (p. 163). Nor are references to "A Wyvern naval interceptor" and "Supermarine 510 (Swift)" in the captions to illustrations any less regrettable.

Nevertheless, there is a great deal of useful reference material. For example, Cdr. Kemp reminds us that, as early as 1911, the Admiralty expected that in the event of war Naval aircraft would be able to: (1) Ascertain what vessels were in enemy ports if they were invisible from a blockading squadron. (2) Ascend from a floating base and ascertain if any enemy ships were in the vicinity. (3) Fly above the fleet and locate submarines. (4) Detect mine-fields. (5) Direct the fire of the guns of the fleet.

This showed remarkable foresight at a time when neither the R.F.C. nor the R.N.A.S. even existed.

"Down in the Drink," by Ralph Barker. Chatto and Windus, Ltd., 40-42 William IV Street, London, W.C.2. Illustrated. Price 12s 6d.

SO many of the finest war stories have been completely ruined by the way they were told, and by the fact that the author has for some reason or other been unable to impart to them the technical verisimilitude they require. Here is a series of stories of the adventures of ditched aircrews during the war which are dramatic and exciting, and told in a style which is perfectly balanced between story telling and report writing. Technically they ring absolutely true, and the narrative is as factual and yet as skilfully presented as one could possibly wish.

Perhaps the most useful lesson they teach on survival—and they might be taken as something of a text book on the subject—is that the most important factor is the mental approach of the "ditchee" to his situation. One feels that those who survived overcame their temperamental difficulties first, and their physical hardships second. The essential is that mind should triumph absolutely over matter—a kind of instrument flight *in extremis*.

"Jet Aircraft of the World," by William Green and Roy Cross. Macdonald and Co., Ltd., 16 Maddox Street, London W.1. Illustrated. Price 30s.

THIS is, without a doubt, the finest and most valuable book that Mr. Green has yet compiled. He set out to include pictures and details of every turbojet-, turboprop- and rocket-powered aircraft ever built and we have been unable to find a single mistake or omission of any consequence.

The prodigious amount of effort put into the book seems to have been well worth while. In terms of statistics, it contains 614 photographs, 30 superb large four-view tone drawings by Roy Cross, 145 three-view line drawings by Norman Blackburn and Ian Huntly, and tens of thousands of words of data on the history, specification, performance and variants of each aircraft. There are five to eight photographs of each of the 30 most important types, in addition to the tone drawings. There are, in addition, sections on "Jet Propulsion Simply Explained," "The Development of Aircraft Jet Engines" (including photographs of flying test-beds and rare variants), tables of data on all gas-turbine engines ever built, three pages of "Jet Helicopters," a table of "Flying Test-beds" and a useful index.

OTHER BOOKS RECEIVED

Sarah Joins the W.R.A.F., by Shirley Darbyshire. The Bodley Head, 28 Little Russell Street, London, W.C.1. Price 7s 6d.

English-Italian, Italiano-Inglese Technical Dictionary. F. le Monnier, Editore, Florence.

Canada's Flying Heritage, by Frank H. Ellis, University of Toronto Press, Toronto 5, Ontario, and Geoffrey Cumberlege. Oxford University Press, Amen House, Warwick Square, London, E.C.4. Price 63s.

With the Australians in Korea, by Norman Bartlett. Australian War Memorial, Canberra. Price 25s.

Gas Turbine Principles and Practice. Consulting Editor, Sir Harold Roxbee-Cox, D.Sc., Ph.D., B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S. George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Price 90s.

The Role of Petroleum in Modern Transport. Edited by George Sell, F.Inst.Pet. The Institute of Petroleum, 26 Portland Place, London, W.1.

The Complete Book of the Model Aeroplane, by Norman G. Taylor. Cassell and Co., Ltd., 37-38 St. Andrew's Hill, London, E.C.4. Price 12s 6d.

Gas Turbine Series: Vol. 1, Cycles and Performance Estimation, by James Hodge, M.A.(Cantab.), M.I.Mech.E., A.F.R.Ae.S., M.A.S.M.E. Butterworths Scientific Publications, 88 Kingsway, London, W.C.2. Price 50s.

Frontier to Space, by Eric Burgess. Chapman and Hall, 37, Essex Street, London, W.C.2. Price 21s.

(Right) The main entrance hall of the new Bristol apprentices' school, referred to below. Above is the large assembly room, capable of holding 200 students and quickly convertible into three separate classrooms.

THE INDUSTRY

Educational Acquisition

AS we reported last week, Sir David Eccles, Minister of Education, opened the Bristol Aeroplane Company's new apprentice school at Filton on March 12th. The two interior photographs above give some idea of the attractive contemporary architecture and decoration of the new building, in parts of which considerable use is made of the aluminium unit system of construction developed by the Bristol Company's buildings division.

The new structure, consisting of a multi-storey and a single-storey block, constitutes stage one of a three-stage scheme. It contains main classroom accommodation, laboratories, library, conference room and administration offices. Stage two, on which work has already started, will replace the two small workshops in the aircraft and engine divisions by a large training workshop, together with further classrooms, and a boiler house; and the final stage will complete the school by the addition of an assembly hall, canteen and kitchens.

The company at present has 1,126 apprentices under training. Nearly 900 attend the school, the remainder having graduated to higher courses at either the Bristol College of Technology or a university.

Rolls-Royce Loss

WE regret to record the death—on March 13th, after a short illness—of Mr. H. Robbins, cost accountant of Rolls-Royce, Ltd. Joining the company in 1919 from the Ministry of Munitions, Mr. Robbins was attached to the cost department during the whole of his service with them. He was appointed chief accountant and, in 1945, works accountant of the aero division. On reaching the age of 65 he retired, but was retained by the company as a consultant on costing and works accountant problems. The funeral took place at Nottingham on March 17th.

Napier appointments: Mr. W. E. Hampton (left), who fills the new post of aviation export representative, has had considerable experience of flight operational management with the Air Ministry and B.O.A.C.—he was in charge of the war-time Mosquito service to Sweden—and also as a pilot on polar expeditions. Mr. Clifford Hollowell (right) becomes publicity manager of the commercial division in succession to the late Mr. A. V. Bellamy. During the past 18 years he has served successively with Faireys, Blackburns and Short Bros. and Harland.

Solar Mars in England

AS briefly recorded last week, when we published a photograph of two of the chief executives concerned, a new British company with an initial capital of £150,000 has been formed to manufacture in England the well-known Mars lightweight gas turbine produced by the Solar Aircraft Company of San Diego, U.S.A.

The new company is Sugg Solar, Ltd., formed as a subsidiary of William Sugg and Co., Ltd., of Vincent Works, Regency Street, London, S.W.1, a firm of manufacturers of engineering components with over 100 years' experience. Their present facilities for precision engineering are A.I.D.- and A.R.B.-approved.

The board of the new company will include Messrs. R. W. Young, chairman; W. T. Mattock, managing director; C. C. Penfold, sales director; and Patrick Johnson and Christopher Dykes, the two last-named representing Solar Aircraft.

Of particular value as an auxiliary power unit for airborne or other applications, the Mars develops up to 60 h.p. and operates at a speed of 40,000 r.p.m. on a wide variety of fuels. The basic engine, including reduction gears, weighs less than 100 lb and is under two cubic feet in volume. Sugg Solar, Ltd., will manufacture the Mars at a works at Crawley, Sussex.

IN BRIEF

A. Cdre. Sir Vernon Brown, technical adviser of the Graviner Manufacturing Co., Ltd., has been appointed to the Board. He is well known as former Chief Inspector of Accidents, Air Ministry (1937-46) and M.C.A. (1946-52).

* * *

A major item in the well-assorted cargo carried in the DC-4 which operated Airwork's first Atlantic service on March 1st was a David Brown 25D diesel tractor on delivery to Canada.

* * *

The Boards of Adamant Engineering Co. (Luton), Ltd., and Western Manufacturing (Reading), Ltd., announce that acceptances have been received by Lazard Brothers and Co., Ltd., in respect of over 91 per cent of the issued share capital of Western Manufacturing. The offer by Adamant to acquire Western's shares has therefore become effective and subject only to permission to deal being granted by the Stock Exchange.

* * *

In his chairman's statement accompanying the accounts of Desoutter Brothers (Holdings), Ltd., Mr. G. H. Webb reports that export sales have increased by 27 per cent and home sales by 14.5 per cent. Profits, before tax, are up by 22 per cent, a result which has been achieved without alteration of price lists and despite the increased cost of wages, materials and services. Net profit after tax is £228,321 (no Excess Profits Levy being payable), as against £57,930 last year.

* * *

Following his resignation from the post of sales director of Export Packing Service, Ltd., Mr. P. A. Andrew has joined the board of United Marine (1939), Ltd., 64 Queen Street, London, E.C.4, packers of machinery, instruments, electrical equipment, etc. During the war he was responsible for the formation and operation of the packaging branch of the M.o.S. Signals and Electronics Directorate. After the war he was the prime mover, with several ex-Service colleagues, in the formation of the Institute of Packaging, of which he was the first president.

ROLLS-ROYCE

AERO ENGINES LEAD THE WORLD

A Rolls-Royce propeller turbine engine was the first to be officially approved for civil aviation.

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Jet Lift

THE author of "Jet Lift" objects to my suggestion that his wing loading was wrong and states that the values I quoted are not demanded for the cruising condition.

I am quite unrepentant; values of the order I quoted are necessary for the cruising condition, always assuming that the aeroplane is intended to have some range!

A Mach number of 1.5 at 60,000ft corresponds to an equivalent air speed of about 270 kt. At this speed, the lift coefficient on an aerofoil load of 300 lb/sq/ft (as he suggests) would be 1.25 and it does not need an aerodynamicist to realize that this figure is about twice what is possible and four (or more) times what is desirable from a lift/drag viewpoint.

"Jet Lift's" real trouble is that he spoke of Mach 1.5. Had he said 3.5 or 5 I should have been with him.

Belfast. SLIPSTICK.

I SHOULD like to make a few comments on the interesting controversy in your correspondence columns aroused by the article on "Jet Lift" in your issue of February 4th.

W/C. Young was being very generous indeed when he conceded the author of "Jet Lift" a specific fuel consumption of 0.5 lb/hr/lb at a cruising speed of 1,000 kt in the stratosphere. This would represent an absolute overall efficiency of about 75 per cent. (At 1,000 kt 1 lb of thrust is producing 3.08 thrust h.p.).

According to my calculations, and making some very optimistic assumptions about engine component efficiencies, there is little hope of doing better than 1.3 lb/hr/lb at 1,000 m.p.h. (which more nearly corresponds to Mach 1.5 than W/C. Young's figure of 1,000 kt). The corresponding static sea level consumption would be about 0.8 lb/hr/lb.

To offset his generosity in the matter of cruising fuel consumption, W/C. Young is parsimonious in the overall lift/drag ratio which he allows—little more than 2 : 1—and his neglect of the very important fact that cruising fuel consumption is reduced as fuel is consumed.

As is well known, the most economical way to cruise a jet aeroplane is to fly at a speed a little above that corresponding to the maximum lift/drag ratio (flight at the speed of maximum L/D is unstable) and to climb gradually as weight is reduced so that L/D remains constant. If this procedure is followed, then the still air distance covered in cruising is given by

$$R_c = -\frac{V_{L/D}}{f} \log_e \frac{W_2}{W_1}$$

where R_c = cruising distance in miles, V = speed in m.p.h., L/D = lift/drag ratio, f = specific fuel consumption in lb/hr/lb and $\frac{W_2}{W_1}$ = the ratio of the all-up weight at the end of cruise to that at the beginning.

Obviously, an aeroplane with very small wings is going to have a lower overall L/D ratio than a more lightly loaded aeroplane and so its range would be less—a fact which seems to be overlooked rather frequently. The explanation of the apparent paradox that an aeroplane with very small wings would have a smaller range than one with large wings is that a plane with higher wing loading would have to cruise at a lower height than would be possible with low wing loading and hence has to be "shoved" through denser air.

One cannot, of course, go on reducing wing loading indefinitely and getting increased range thereby, because there comes a point where the improvement in overall L/D begins to approach the limiting value of that of the wing alone and is neutralized by the increased structure-weight, increased powerplant weight, and increase of fuel for climb; but, without attempting detailed computations, my guess is that optimum wing loading would lie somewhere between 50 and 100 lb per square foot and so, as "Slipstick" points out, there would be no problem in landing and taking off in the conventional manner. The advantage of V.T.O. then boils down to freedom from dependence on conventional airfields and the saving of undercarriage weight.

I estimate that a jet-take-off, pilotless, one-way bomber (i.e., large missile) could be 87 per cent of its take-off weight at the beginning of cruise and could carry 50 per cent of its initial take-off weight as fuel for cruise, i.e., the $\frac{W_2}{W_1}$ ratio could be as low as 0.37/0.87 = 0.425. Then, provided the overall L/D were not less than 5 at 1,000 m.p.h. in the stratosphere and the s.f.c. not more than 1.3 lb/hr/lb, the distance flown on cruise would not be less than 3,280 miles—which is a very disturbing conclusion for people at the potential receiving end. The range could be very much greater if only part of the distance were flown at supersonic speeds. (In making this estimate I have assumed that the same engines are used for take-off, climb and cruise. The figures would be much less favourable if separate engines were used for take-off).

All the fuss and excitement caused by the use of jet engines for direct lift is rather surprising. The possibilities in this direction became obvious from the day in December, 1940, when Power Jets' W.1.X. engine produced a thrust well in excess of its own weight.

Even more surprising is the curious (to put it mildly) method used in the "Flying Bedstead." It would be hard to imagine a less practical solution. If this represents an approximation to the latest development in this field in the U.K., then we at least must be a long way from the V.T.O. long-range supersonic missile which is clearly possible. F. W.

London, W.1.

[A particular discussion on this subject, between W/C. G. Young and the author of the original article, has become so lengthy that we are reluctantly compelled to withhold it from these pages; but should agreement be reached on major points we may find it possible to publish further comments—Ed.]

"Royal" Heron and Viking

REFERENCE the caption shown against the photograph of H.R.H. Princess Margaret (page 183, February 11th issue) may I point out that in one at least of the inter-island flights the Princess flew in a Viking of B.W.I.A. (flown, I believe, by B.W.I.A.'s chief pilot) whilst the D.H. Heron also used was a Series 2 machine normally used by the British Ambassador and Air Attaché in Washington, D.C.? It bears the R.A.F. Serial No. XG-603. For some curious reason, neither of these two British aircraft has been widely publicized in connection with the recent royal tour as compared with the lavish publicity put out by B.O.A.C. in reference to *Canopus*.

Nairobi, Kenya. DENNIS M. POWELL.

Filming from a Helicopter

READERS interested in helicopters may like to know that a film which has been showing recently in London, entitled "Break in the Circle," features one of Autair's S-51 helicopters quite prominently in a part of the story.

Several good shots of the machine are included, and also a number of sequences taken from the helicopter itself. In the latter sequences the picture follows an escaping truck along a road from a low altitude, and I think the most interesting feature of this is that the characteristic "once per rev," which is usually clearly discernible in landscape ciné-film taken from a helicopter, is not present in this film.

This is partly due to the anti-vibration mounting for the camera and is partly psychological, as the interest of the spectator is entirely taken up with the action of the scene.

To an experienced eye looking for imperfections at a specific point in the film, the slight residual "once per rev" is just discernible; but I am sure it could not be detected by the layman, and I think this augurs well for the wider use of helicopters in film making. B. H. A.

London, S.W.1.

Flying-boat Regularity

IT is sad to discover, by personal experience on a recent visit to Madeira, that even flying-boats as large as the Solent class (78,000 lb all-up weight) are likely to be delayed for three, four or five *days* at a time by swell in a bay which is calm to the unpractised eye. Such irregularity may be acceptable at a pinch on holiday routes, but would clearly be uncompetitive on the New York or South American runs.

This should in no way be taken as a disparagement of the Solent class: they do certainly offer extraordinary comfort even by today's standards, and an agreeable feeling of space within and stability without. J. A. KAY.

Paris XVI.

[Aquila Airways, operators of the Madeira service, state that they fix a 4ft (crest above trough) swell as a limit, and doubt if such conditions "could appear calm even to the unpractised eye." Serious delays such as that mentioned by our correspondent do not, they say, occur more than two or three times a year, in spite of the admittedly unsheltered nature of Funchal harbour. They add that "In any such discussion one should distinguish between those places to which flying-boats are operated because there are no landplane facilities, and those places to which both types of aircraft could be operated"—Ed.]

Trans-Australia Airlines' sixth Viscount, "Ernest Giles," is the first to carry slipper tanks—seen outboard of the outer Darts. Easily attached or removed on the ground, these tanks enable an additional 290 gallons of kerosine to be carried, increasing the Viscount's still-air range with maximum payload (12,800 lb) from 1,400 to 1,655 miles.

CIVIL AVIATION

T.C.A IN 1954

IN spite of heavy expenses in connection with its acquisition of new aircraft, Trans-Canada Air Lines achieved a net surplus—for the fourth successive time—for the calendar year 1954. The number of passengers carried increased by ten per cent over 1953, passenger traffic remaining the major source of revenue.

In the company's annual report for 1954, the following traffic statistics are given:—

	1954	1953	Percentage Increase
Passengers carried ...	1,438,349	1,307,810	10
Passenger-miles flown ...	852,475,532	759,319,800	12
Aircraft-miles flown ...	32,327,404	31,737,638	2
Revenue ton-miles flown	102,305,202	89,149,605	15
Ton-miles available ...	158,093,399	149,140,771	6
Mail ton-miles	6,942,299	5,373,841	29
Freight ton-miles ...	8,345,258	6,245,368	34
Air Express ton-miles ...	1,787,000	1,648,741	8

Operating revenue totalled $68,764,252 (£24,558,661) and operating expenses $67,731,512 (£24,189,826), giving an operating surplus of $1,032,740 (£368,835). The net surplus for the year was $496,146 (£177,195). Major factors in the rise of expenses were stated to be increased services to the public, labour costs, and development expenses from which little compensating revenue could be expected during 1954. The specific cost of production increased by four per cent to 42.86 cent (36.5d) per available ton-mile, but was balanced by an equivalent rise in specific revenue.

Investment in property and equipment during the year totalled $17,950,000 (£6,410,290), of which $14,920,000 covered the purchase of eight Super Constellations and the first of T.C.A.'s Viscounts, together with spares. Commitments for the acquisition of aircraft during the next three years amount to $21,400,000 (£7,642,900), partially offset by progress payments to date totalling some $3,300,000 (£1,178,100).

At the end of 1954 the T.C.A. fleet comprised seven Super Constellations, 22 North Stars, 26 DC-3s, one DC-3 "Cargoliner" and three Bristol Freighters. One Viscount was employed in ground and aircrew training. The number of personnel was 7,991, an increase of 13 per cent, stated to be required by "the greater workload and by necessary provision for the further planned expansion of fleet and operations."

DUTCH HELICOPTER CONFERENCE

ORGANIZED by the Rotterdam Helicopter Syndicate, a congress to discuss problems arising from the use of helicopters as transport aircraft will be held in Rotterdam from July 27th to 29th inclusive. Delegates, who will include leading figures in the development of rotorplanes in many parts of the world, will discuss the commercial possibilities of helicopters now and in the future, and will also consider the construction of heliports. Details of the congress can be obtained from the Secretary of the Syndicate at Exchange Building, Coolsingel 58, Rotterdam.

U.A.L. PROFITS UP

NEW records in traffic volume and revenue enabled United Air Lines to increase net earnings by 6 per cent to a total of $9,617,694 (£3,434,700) in 1954, according to a shareholders' report recently issued. Revenue and expenses both rose by 16 per cent; and revenue exceeded $200m for the first time. Almost five million passengers were carried, and other statistics include 3,326,736,000 revenue passenger-miles (22 per cent increase over 1953), 23,701,000 mail ton-miles (14 per cent increase), 34,264,000 freight ton-miles (22 per cent increase), and 388,173,000 total ton-miles (21 per cent increase).

Plans for handling an even greater volume of passenger, mail and cargo traffic were reviewed at the company's 1955 "Flight Plan" meeting in San Francisco, from which Mr. James Miller, United's European director, has recently returned. The proportion of "air-coach" traffic is to rise from 27 to 32 per cent of the total available seat-miles, and passenger and freight increases in traffic of about 15 and 10 per cent respectively are anticipated.

With landing gear just beginning to fold in, Britannia G-ANBA takes off on its tropical trials. The aircraft is in Johannesburg, having flown there via Khartoum (as reported in last week's issue). The trials are expected to last about a month. Elsewhere in this issue reference is made to a new order for three Mk 300 L.R. Britannias which has just been placed by El Al Israel Airlines.

FOCUSING ON NEXT YEAR'S AIRLINER,

MR. ARNOLD?

Mr. Arnold (busy news photographer) is himself a very tricky person to get in focus. No sooner here . . . he's got to be somewhere else . . . and fast. Of course he always gets there — by air; and he invariably flies British. *Which is where next year's airliner comes in.* For Mr. Arnold's fares are helping to put yet another British world-beater on the stocks. Helping to pay the men who design and build her; and helping BEA to send air line technicians to advise on the operational aspects. Mr. Arnold was one of nearly 2 million people who flew BEA last year. That's why British Civil Aviation is on top. And passengers who fly British this year — and next — are making sure we stay there.

fly **BEA**

fly British

with BRITISH EUROPEAN AIRWAYS

EUROPE'S FAVOURITE AIRLINE

Now in Australia...

the Viscount is showing its paces as a record-breaker for Trans-Australia Airlines.

PASSENGERS

7,520 in 26 days (190 flights from December 18 to January 12)

LOAD FACTOR

90.4% (Two Viscounts used December 18 - 31 and three January 1 - 12)

RELIABILITY

Viscounts have been fully serviceable since their introduction—no breakdowns or delays.

Once again, the Viscount on entering service has followed the familiar pattern — immediate passenger appeal and high utilisation within a very short time.

VICKERS VISCOUNT

FOUR ROLLS-ROYCE DART PROPELLER-TURBINE ENGINES

VICKERS-ARMSTRONGS LIMITED · WEYBRIDGE · SURREY

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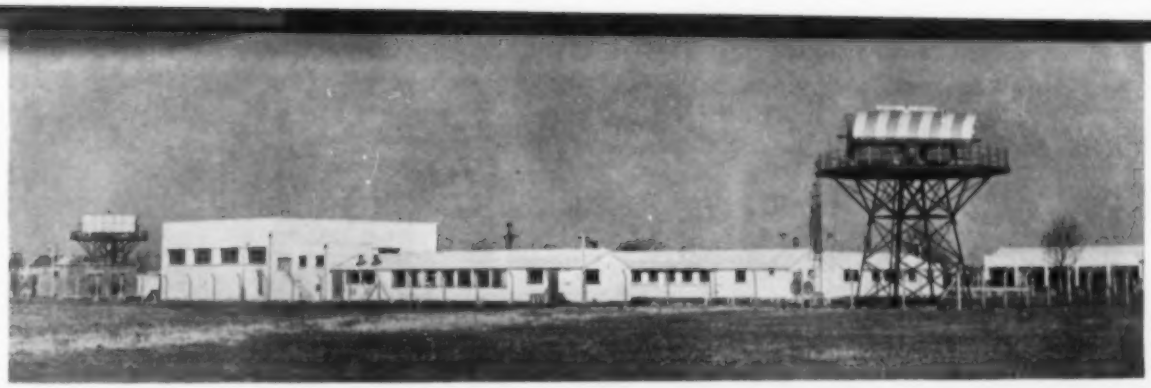


The new Southern Air Traffic Control Centre, shown above, is situated at London Airport. Right, inside the operations room, flight progress boards and radar displays can be seen. "Flight" photographs

CIVIL AVIATION . . .

SOUTHERN AIR TRAFFIC CONTROL

A NEW air traffic control centre for the southern area of the U.K., located at London Airport, will come into use on April 3rd. It will replace the air traffic control centre at Uxbridge, which was separated from its associated long-range radar unit at London Airport by five miles of telephone wires. As radar is now accepted as an essential part of the control system, rather than as an adjunct, the new centre is self-contained in this respect, and the "procedural" air traffic controllers will work together with radar controllers in the one operations room.

This fundamental change has enabled the new centre to be designed on extremely efficient lines. The six flight-progress boards at which the procedural controllers work in the operations room are similar to those at Uxbridge, but are situated near to their respectively associated radar displays. The display consoles are of refined design, and for ease of maintenance most of the associated equipment is located in the basement directly below the operations room.

The radar installations consist of long-range, short-range and height-finding equipment. Amber screens are fitted over the display tubes, enabling them to be viewed clearly without interference from the relatively bright lighting over the flight progress boards. This lighting is deficient in yellow colour, being a mixed light from blue, green and red fluorescent tubes. Also situated in the operations room are a meteorological section (with teleprinters and forecast bench), and an R.A.F. liaison unit which is in direct contact with the R.A.F. air traffic control at Uxbridge.

In addition to the radar installations, complex systems incorporating V.H.F. R/T., G.P.O. telephones and "communicators" (teleprinter operators who pass on company and other messages from aircraft) are essential to the centre's operation. With these facilities, the unit is claimed to be the most modern and ambitious air traffic control centre in the world.

B.E.A. FARES INCREASE

IN the House of Commons on March 16th, Mr. Boyd-Carpenter, Minister of Transport and Civil Aviation, said, "With my approval, British European Airways is increasing the fares on certain services within the United Kingdom as from April 1st. The increases, which vary in amount but are mostly between five and 15 per cent, are intended to reduce the substantial losses incurred by B.E.A. on internal services. The fares on these services remain, on average, some 30 per cent below the level of those on the Corporation's international services."

It may be recalled that April 1st is also the date on which the I.A.T.A.-agreed fare increases for scheduled operators on European international routes will take effect.

"John Hunter," one of the two new D.H. Herons for the Scottish Air Ambulance Unit, named by Miss Jean D. Jolly, matron of the Southern General Hospital, at Renfrew last Friday. The Rapides now in use will go out of service on April 17th. Details of the ceremony and of the B.E.A.-operated ambulance service will appear in a forthcoming issue. "Flight" photograph

B.O.A.C. FLEET ORDERS COMPLETE

WITH the signing of a £13m contract for 10 Douglas DC-7Cs by Sir Miles Thomas in London last Friday, B.O.A.C. orders for replacement aircraft are now complete. Other aircraft on order are 20 Comet 4s and 33 Britannias.

The DC-7C order includes spares engines and other parts. Delivery is expected between October 1956 and March 1959 at an initial rate of one aircraft per month, increasing to two per month.

CANADIAN ACCIDENT REPORTS

THE respective findings of the Boards of Inquiry into the aircraft accidents near Moose Jaw, Saskatchewan and Brampton, Ontario, last year, were recently published by the Canadian Department of Transport. The primary cause of the mid-air collision between an R.C.A.F. Harvard and a T.C.A. North Star over Moose Jaw on April 9th, in which all passengers and crew members were killed, was stated to be the failure of the pilots of both aircraft to maintain a proper lookout, while negligence on the part of the Captain was also given as the cause of the second accident, in which a T.C.A. Super Constellation crash-landed during an I.L.S. approach to Malton Airport, Toronto, on December 17th, with no fatalities.

The first accident occurred as T.C.A. North Star CF-TFW was flying at 6,000ft on Green Airway No. 1 between Winnipeg and Calgary, on a westerly flight from Toronto to Vancouver. R.C.A.F. Harvard No. 3309, which had taken off from R.C.A.F. Station Moose Jaw on a solo navigation exercise, was crossing the airway on a northerly course when the two aircraft collided.

Pilots of both aircraft, the report states, failed to maintain a proper lookout; the onus of responsibility for keeping out of the way being with the Harvard pilot, as he had the other aircraft on his right.

The Board's recommendations included the specification of revised cruising altitudes; that elementary flying training be conducted clear of airways; that airline pilots should be required to remain at the controls and maintain a proper lookout within a radius of 25 nautical miles from an airport; that the field of vision from the pilot's cockpit of all Canadian civil aircraft be

CIVIL AVIATION . . .

investigated; and that a collision-warning device be developed.

The second accident occurred as an instrument approach to Malton Airport, Toronto, was being made at the end of a flight from Tampa, Florida. The procedure followed by the captain of the aircraft, the report states, caused him to break three regulations in that he went below 2,000ft without having first intercepted the glide path; he had not yet reached the outer marker and should not therefore have been below 1,600ft; and he descended below the T.C.A. minimum altitude for a Malton approach while still flying on instruments. The findings of the Board included:—

"Evidence indicated that the Malton I.L.S. equipment was functioning normally.

"The First Officer, despite his duties which involved 'in-range' and 'pre-landing' checks, displayed an alertness during the approach pattern concerning the procedures carried out by the captain, and on three separate occasions indicated to the captain conditions which required correction.

"The captain of the aircraft showed poor airmanship in the execution of his approach pattern, in that he made inadequate allowance for the strong prevailing wind and failed to utilize the A.D.F. receiver to home on the outer marker.

"The captain failed to carry out an approved I.L.S. let-down and, insofar as the position and altitude of the aircraft were concerned, he ignored the indications of the A.D.F. needle tuned to the marker, the I.L.S. glide-path needle and the altimeter."

After stating that the Board had found that the accident was caused by negligence on the part of the aircraft captain, the report concludes with a discussion of the findings, and with recommendations. Among the more important items in this section was a consideration of the total duty time involved in the round trip from Montreal to Tampa and return (stated to be 16 hours, approximately 12 hr of which is flying time). While admitting this to be a long working day, the Board describes it as less arduous than a typical trans-Atlantic flight and, provided the crew have adequate rest on the preceding day, "not a particularly arduous assignment with modern flying equipment."

Concerning "the question of intercommunication between the captain and first officer during periods of flying which demand more than normal concentration, such as an instrument approach," the Board notes that the first officer had "adopted standard procedure" in calling the captain's attention to an irregularity, a critical error and finally imminent danger in the flying of the aircraft. "If, instead, the first officer had quickly assumed control of the aircraft, it is quite possible that disaster could have been averted."

BREVITIES

THE fifth convention of the International Airline Navigators' Council will take place in San Francisco, California, U.S.A., from April 14th to 16th. This was recently announced by M. Henri Almin (Air France), the chairman of the council.

* * *

First all-cargo service between Manchester and New York was introduced by Swissair on February 19th, using a DC-4 at a frequency of one flight per week.

* * *

Mr. Donald Scott, in charge of the aeronautical radio services operated by Cable and Wireless, Ltd., is to become an assistant engineer-in-chief of the company from April 1st.

* * *

Following representations by F.I.T.A.P., the international association of independent operators, the French Minister of Transport has withdrawn the decree calling for the extension of application of airport passenger tax to all French airports.

* * *

A public inquiry into the accident to B.E.A. Viscount G-AMOK on January 16th at London Airport, involving an attempted take-off along a disused runway, has been ordered by the Minister of Transport and Civil Aviation.

* * *

Mr. F. J. Mullins has been elected vice-president and general manager of American Airlines de Mexico, S.A., wholly owned subsidiary of American Airlines, Inc. He succeeds Mr. George C. Van Nostrand, who is now vice-president (properties and community affairs) of American Airlines.

* * *

Pakistan International Airlines' London-Karachi service, using Super Constellations, is to operate at a frequency of two flights, instead of one, per week. The additional flight will include a traffic stop at Paris. Since the introduction of the London-Karachi service in January, a new service between Karachi and Delhi has been inaugurated, and a Dacca-Rangoon service is planned.

* * *

An illustrated booklet, *Gateway to the World—The Illustrated Story of London Airport*, has recently been published at 1s 6d by Thames Valley Art Productions, 1 Shoe Lane, Oxford. Mainly intended as a guide for the many people who visit the airport each year, it has been written by Mr. Maurice Housego, M.T.C.A. public relations officer at London Airport.

CLUB AND GLIDING NEWS

AT Croydon Airport on Saturday last, the Surrey Flying Club's new clubhouse was officially opened by the Mayor of Croydon, Alderman Basil Monk, M.B.E., J.P. The trim fleet of four Tiger Moths, one Messenger and one Hornet Moth was aligned in front of the new building as the Mayor arrived and was welcomed by Dr. A. P. Thurston and Mr. Duncan Lush.

The fact that the occasion was entirely the result of the efforts of the members themselves—in deciding to find somewhere else to continue flying when their previous base at Redhill closed down, and in actually building the clubhouse—was emphasized by Alderman Monk in a brief speech. He read a message from the Mayor of Southend, referring to the close liaison which had existed between the Redhill Club and the Southend Flying School, and went on to trace briefly the history of flying at Croydon since 1915.

Having pocketed the special presentation key (which did not fit—and, indeed, was not intended to fit—the door) and unveiled an appropriate plaque, the Mayor opened the clubhouse with an ordinary unceremonial key (which did fit) and inspected the premises. These were seen to be pleasantly decorated, and complete with the essential bar and duty-pilot list already on the notice board. Photographs on one wall depicted various stages in the construction of the clubhouse, starting from the foundations—a rectangular trace in an otherwise flat expense of snow.

During the afternoon the four Tigers performed a formation fly-past, and later escorted the Messenger-borne Mayor on an aerial perusal of his local domain. Numerous congratulations continued to be received by club members, including C. F. I. Sproxton and Secretary Chinn, as refreshments were dispensed, eaten and drunk. A film show and an informal dance in the evening completed the day's celebrations.

FOLLOWING the formation of an R.C.A.F. flying club at North Luffenham last summer, a similar club has recently been formed by personnel of the R.C.A.F. station at Rockcliffe, near Ottawa. This is the first such club to be granted a charter by the Royal Canadian Flying Clubs Association, and it operates its four light aircraft from Carp Airport, Ottawa.

THE first air rally organized by the Association of Central African Flying Clubs was held at Gatooma, Southern Rhodesia, on February 27th. Aerobatic, spot landing, and flour-bag-bombing competitions took place, the local arrangements being in the hands of the Gatooma Flying Club. The Association intends to hold further functions during the year, including a 100-mile closed-circuit race for the Herald Cup and altitude-record attempts for the Castle Brewery Cup.

FORTHCOMING EVENTS

Mar. 25. College of Aeronautics Senior Common Room Society: Annual dinner.

Mar. 25. British Interplanetary Society (Bristol branch): (a) "Design Study of a Venus Probe," by members of the branch, (b) "Photography in Interplanetary Travel," by G. Nichols.

Mar. 25. Institute of Welding: Annual dinner and ladies' night.

Mar. 26. Air-Britain: Annual General Meeting, 2 p.m., Londonderry House.

Mar. 26. Rugby, Twickenham: R.A.F. v. Army.

Mar. 26. S.L.A.E. (S.E. area): Film show.

Mar. 28. Royal Society of Arts: "The Mechanical Properties of Metals—(3) Fatigue," by Maj. P. L. Teed, F.R.Ae.S.

Mar. 29. British Interplanetary Society (Glasgow branch): "Pilotage and Navigation of Interplanetary Vehicles," by P. Tanner, B.Sc.

Mar. 29. R.Ae.C.: Film Show.

Mar. 29. R.Ae.S. Graduates and Students Section: "Atomic Energy," by Prof. J. Rotblat.

Mar. 30. British Institution of Radio Engineers: Discussion: "The Maintainability of Service Equipment." (Speakers include W/C. G. C. Godfrey, for R.A.F.)

Mar. 30. Institute of Transport (Tees-side Section): "Problems and Prospects in British Air Transport," by Peter G. Masefield, F.R.Ae.S., M.Inst.T., F.I.Ae.S.

Mar. 30. Royal United Service Institution: "Allied Naval and Air Commands in the Mediterranean," by Admiral The Earl Mountbatten of Burma, K.G., P.C., G.C.S.I., G.C.I.E., G.C.V.O., K.C.B., D.S.O.

Mar. 31. R.Ae.S. Section lecture. "Aerial Survey in the Economic Development of a Country," by T. D. Weatherhead, O.B.E., M.A.

"Flight" photograph

The Thunderjets of the two visiting Norwegian squadrons lined up at North Weald after their arrival in Britain.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

NORWEGIAN VISITORS

ON March 15th, as briefly reported in last week's issue of *Flight*, Nos. 331 and 332 Squadrons of the Royal Norwegian Air Force flew their F-84G Thunderjets into North Weald on a good-will visit to the Royal Air Force.

Shortly before they came in, Lt-Gen. Finn Lambrechts, D.F.C., C-inC. Royal Norwegian Air Force, arrived in a Dakota. He was accompanied by Maj-Gen. Motzfeldt, C.V.O., O.B.E., Air Commander Norway; Col. Widerberg, Sola Sector Commander, and the war-time commanders of the two squadrons, Col. W. Mohr, D.F.C., and Col. Gran, D.F.C.

To greet the visitors on their arrival at North Weald were Marshal of the Royal Air Force Sir William Dickson, Chief of the Air Staff; Air Marshal Sir Dermot A. Boyle, A.O.C-in-C. Fighter Command; G/C. G. V. Eveleigh, Station Commander North Weald; and Lt-Col. E. Sandberg, D.F.C., the Norwegian Air Attaché in London.

For the squadrons the visit was a return to their war-time home, for it was from North Weald that the two units operated against the Luftwaffe from 1942. On the station is a memorial to the Norwegian airmen, and shortly after the arrival of the visitors wreaths were laid by both the Norwegians and the Royal Air Force.

No. 331 Squadron was the first Norwegian fighter squadron to be formed in the last war—at Catterick on July 21st, 1941. It was equipped with Hurricane IIBs. In the following November the Hurricanes were replaced by Spitfires and early in 1942 the Squadron moved to North Weald and went into action, taking part in the majority of the large-scale offensive operations then mounted by Fighter Command over occupied France and the Low Countries. One of the highlights of 1942 was the part they took in the combined operations raid on Dieppe.

No. 332 Squadron was formed at Catterick in January, 1942, equipped with Spitfires, and becoming operational in the following March. In June 1942 it moved to North Weald where, with its sister squadron, it was engaged in sector defence and in protective patrols of shipping convoys sailing off the east coast. Later the squadron joined in the large-scale fighter sweeps over the Continent. After the end of hostilities the squadron moved to Norway with the Allied Occupation Forces.

Over a period of three months in 1943, the two units were among the top-scoring squadrons of Fighter Command. At the end of the war in Europe, they claimed between them 196 enemy aircraft destroyed, 34½ probably destroyed and 123½ damaged.

In November 1945 the two squadrons were formally transferred to the Royal Norwegian Air Force.

Lt-Gen. Lambrechts is himself an experienced pilot. He took part in the expedition to rescue the polar explorer Amundsen in 1928 and made the first Norwegian flight to Spitzbergen in 1933. During the war he served with the R.A.F., commanding No. 333 Squadron, which was stationed at Leuchars.

The programme for the visit included a number of social occasions, some local flying and sight-seeing in London. Three days were spent with the U.S.A.F. at Sculthorpe and Burtonwood before the squadron flew home last Monday.

(Left) Lt-General Lambrechts is greeted by the Chief of the Air Staff, Marshal of the Royal Air Force Sir William F. Dickson. (Right) The Station Commander, G/C. G. V. Eveleigh, places a wreath on the Norwegian memorial at North Weald.

"Flight" photographs

Three Canberras of No. 27 Squadron over the northern coast of Cyprus—where, with No. 21 Squadron, they have recently completed a month's detachment with M.E.A.F.

A Firefly 5 from the Scottish Air Division R.N.V.R. passes over Paisley while on a reconnaissance during "Exercise 1984," which took place in the Mull of Galloway last week-end. The Northern and Midland Divisions also took part.

SERVICE AVIATION . . .

Duchess of Gloucester's Tour

STARTING on Tuesday last, H.R.H. the Duchess of Gloucester, Air Chief Commandant of the W.R.A.F., was due to pay a two-day visit to R.A.F. units in the West of England, including H.Q. No. 19 Group, R.A.F. Coastal Command, at Mount Batten, Plymouth, the Coastal Command station at St. Eval, Cornwall, and the R.A.F. Medical Rehabilitation Centre at Collaton Cross, Devon.

The Duchess was expected to arrive at St. Eval at 1130 hr last Tuesday, in a Viking of the Queen's Flight, and be greeted by the A.O.C. No. 19 Group, A.V-M. G. W. Tuttle, and the Director of the W.R.A.F., Air Commandant Dame Nancy Salmon. In the afternoon Her Royal Highness expected to leave St. Eval in an S-51 helicopter attached to the Queen's Flight for R.A.F. Mount Batten.

R.A.F. Appointments

THE following appointments have been announced by the Air Ministry: A.V-M. A. F. Hutton, C.B., C.B.E., D.F.C., to be Director-General of Engineering at the Air Ministry; A.V-M. J. G. Franks, C.B., C.B.E., to be Senior Air Staff Officer, Technical Training Command; A.V-M. R. G. Hart, C.B., C.B.E., M.C., to be A.O.C. No. 41 Group, Maintenance Command; A. Cdre. F. G. S. Mitchell, C.B.E., to be Air Officer in charge of Administration, Maintenance Command and A. Cdre. G. B. Beardsworth, C.B., to be A.O.C. No. 24 Group, Technical Training Command. Both A. Cdre. Mitchell and A. Cdre. Beardsworth will assume the acting rank of air vice-marshal.

A.V-M. Hutton entered the R.A.F. with a general duties commission in 1924 and —after squadron service mainly in India, where he gained his D.F.C. in 1936—transferred to the Technical Branch in 1940, when it was established.

To take up his new appointment A.V-M. Hutton relinquishes his present post of S.A.S.O. Technical Training Command, which position is now taken over by A.V-M. J. G. Franks.

A.V-M. Franks passed out from Cranwell in 1926 and flew with No. 56 Squadron. The many important appointments held by him include those of Superintendent of Armament Tests at A. and A.E.E., Boscombe Down; Director of Armament Research and Development (Air); Commandant of the Empire Air Armament School and A.O.C. and Commandant of R.A.F. Technical College, Henlow.

A.V-M. Hart, an old Royal Flying Corps man, flew with No. 15 Squadron on the Western Front in 1917 and won the Military Cross. As a member of Sir Robert Watson-Watt's team he played a leading part in the introduction and operational development of radar before and during the early part of the last war. He has been Director-General of Engineering for the past four years.

A.V-M. Mitchell was a member of the first entry to Cranwell in 1920 and on being commissioned served with No. 27 Squadron in India. He spent the first three years of the war as Air Force Experimental Officer with the Chemical Defence Experimental Establishment and later went to M.A.P. as Assistant Director of Research and Development.

A.V-M. Beardsworth is an engineering specialist, having during the past four years served as Director of Air Engineering and S.T.S.O. at H.Q. F.E.A.F. In the years between the wars he flew with No. 28 Squadron, spent two years on torpedo development duties and commanded No. 36 (Torpedo-Bomber) Squadron, then equipped with Vickers Vildebeeste aircraft.

Naval Weapon Changes

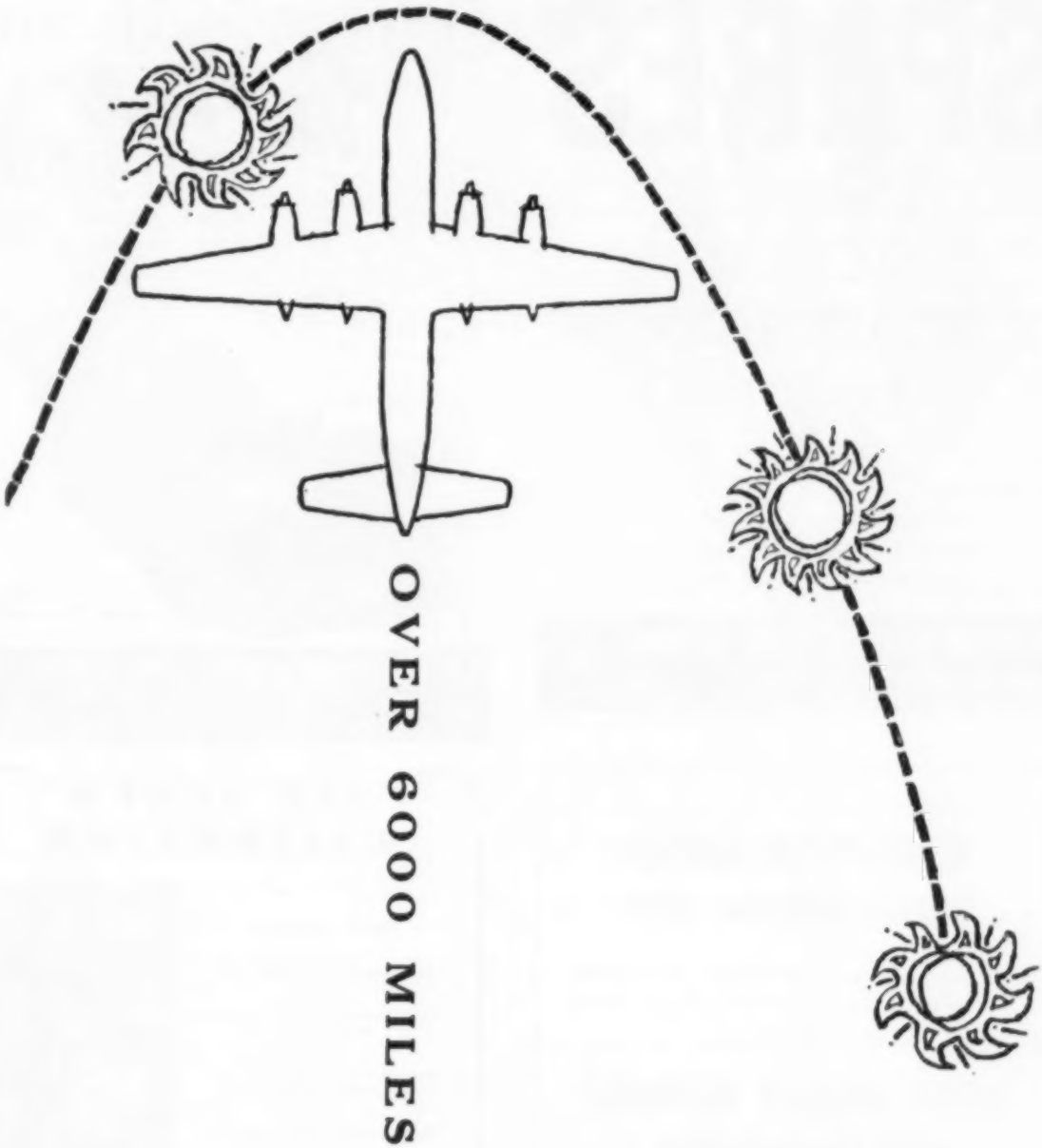
A REVIEW of the responsibilities for weapons in use in the Navy has been made in the light of changing circumstances and past experience. This has led to the adoption of the policy outlined below.

The Gunnery Branch, who have for some years been dealing with guided weapons as well as with naval gunnery, have now taken over airborne gunnery in all its forms, including rockets and bombs. They have also been charged with responsibility for such atomic weapons as may be developed within their sphere. The Torpedo Anti-Submarine Branch have similarly become responsible for all weapons which function under water.

As a result of these re-adjustments, the Air Armament School has been moved from R.N.A.S. St. Merryn to H.M.S. *Excellent*, the gunnery school at Whale Island, Portsmouth, and the syllabus for the training of specialist gunnery officers has been modified. A part of the course is now spent at a Naval air station and includes flying experience during weapon exercises as part of the training. Similarly the course for specialist torpedo anti-submarine officers has been modified and includes flying experience during a course in air weapons at a Naval air station.

For close integration of air and weapon experience, a certain number of Fleet Air Arm pilots and observers will specialize in gunnery and torpedo anti-submarine work, and attend the specialist courses.

Admiral Sir Denis W. Boyd presents the Boyd Trophy to Cdr. S. G. Orr, who accepts it on behalf of the winners, the Naval Test Squadron of the Aeroplane and Armament Experimental Establishment at Boscombe Down. Both Sir Richard Fairey and Vice-Admiral Caspar John were present at the ceremony, which was held at Lee-on-Solent.



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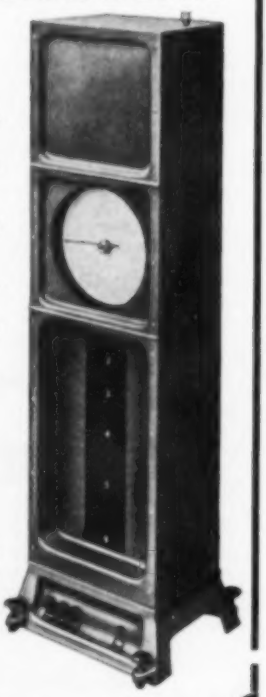

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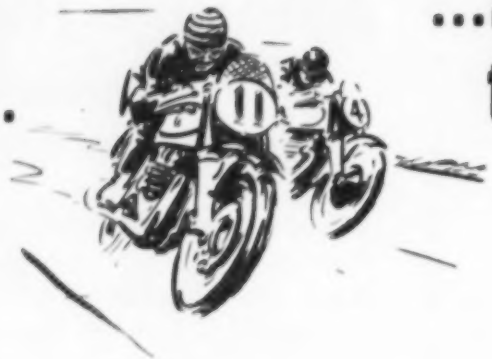

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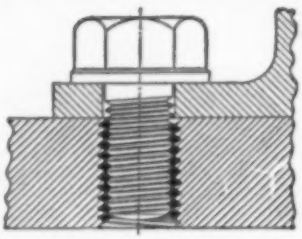

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Vacancy for experienced engineer to specialise in estimating weights of new projects.

Good technical qualifications and experience in this class of work essential.

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Post carries excellent salary with ample scope for advancement, as well as participation in Pension Scheme and free Life Insurance.

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AMERICAN and British aircraft cameras; large stocks of latest models available, including F24, F52, K8a, K20, K24 and G45, etc. Also spare parts, lenses, films, equipment, etc. Inquiries will receive immediate attention.

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Hunting-Clan Air Transport, Ltd., of 5, Fitzhardinge Street, Portman Square, London, W.1, for the following Inclusive Tour Services to be operated with Dakota and/or Viking aircraft in conjunction with Irish Holidays, Ltd. for the carriage of passengers only booked to stay at the Red Island Holiday Camp at Skerries, County Dublin:

Application No.	Route	Frequency	Period
466	London Airport-Dublin	1 return flight on Saturdays from	18.6.55 to 27.8.55 inclusive.
467	Liverpool-Dublin	1 return flight on Saturdays from	4.6.55 to 10.9.55 inclusive.
468	Newcastle-Dublin	1 return flight on Saturdays from	4.6.55 to 10.9.55 inclusive.
469	Manchester-Dublin	1 return flight on Saturdays from	21.5.55 to 17.9.55 inclusive.

FROM B.K.S. Air Transport, Ltd., of 1, Marylebone High Street, London, W.1:

APPLICATION No. 470. For a Normal Scheduled Service with Dakota and Viking aircraft for the carriage of passengers, supplementary freight and mail between Leeds (Yeadon) and Dusseldorf with an intermediate traffic stop at Amsterdam at a frequency of from one to seven services weekly for a period of 10 years, commencing one month after date of approval.

APPLICATION No. 471. For a Normal Scheduled Service with Dakota and Viking aircraft for the carriage of passengers, supplementary freight and mail between Leeds (Yeadon) and Paris (Le Bourget) at a frequency of from one to seven services weekly for a period of 10 years, commencing one month after date of approval.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3479

ELECTRONIC ENGINEERS

are required by the

English Electric Co.
LIMITED

to fill vacancies in the Company's Laboratories at

LUTON & STEVENAGE

1. **SENIOR MICROWAVE ENGINEER**—applicant should have a good theoretical background to degree standard and experience of design or engineering of microwave equipment. The work includes investigation of new methods of construction with a view to miniaturization and weight reduction.

2. **SENIOR ENGINEER**—to lead a group of engineers in the development of specialized electronic test gear.

3. **SENIOR ENGINEER**—for work on general circuit development, with sound fundamental knowledge of electronics and the ability to apply it.

4. **SENIOR INSTRUMENTATION ENGINEERS** — with a degree or H.N.C. and experience of the design of equipment for use in the instrumentation field.

5. **SENIOR ENGINEER**—to lead a group concerned with development and field trials of ground radar. Previous experience essential.

6. **SENIOR RADAR AND ELECTRONIC ENGINEERS**—for development and field and flight experiments of radar equipment. Degree or H.N.C. standard preferred but applicants without these qualifications but with wide experience of this work considered.

7. **SENIOR ENGINEER**—for missile telemetry installation planning. Applicants must be familiar with existing telemetry systems and measuring techniques, suitable to a man with trial experience.

8. **JUNIOR ENGINEERS AND LABORATORY ASSISTANTS** — are required to assist in the above work. Vacancies also exist for junior staff with experience of, or an interest in microwaves.

Housing assistance may be given in some cases.

All of the above posts are permanent and progressive and pensionable after qualifying period, attractive salaries are offered to the successful applicants. Applications should be sent to

Dept. C.P.S.
336/7 Strand, W.C.2
quoting ref. no. 1260B.

PUBLIC APPOINTMENTS

FEDERATION OF RHODESIA AND NYASALAND

DEPARTMENT OF CIVIL AVIATION

Vacancies: Aeradio Operators, Aeradio Operator/Mechanics, Aeradio Mechanics.

APPLICANTS for all posts must be British subjects under 35.

AERADIO OPERATOR. Applicants must be able to pass a Morse sending and receiving test in plain language, code and cypher at speeds equivalent to 25 w.p.m. in plain language and transcribe received Morse signals direct on to a typewriter. Previous experience in the operation of teleprinter, perforators for automatic W/T transmission and HF/VHF D.F. and a satisfactory knowledge of I.C.A.O. regulations and procedures is necessary. Possession of a P.M.G. 1st class certificate will be an advantage.

Applicants who are unable to transcribe received Morse signals direct on to a typewriter, but are otherwise suitable may be accepted subject to their handwriting being of a good standard.

Commencing salary—£880 per annum, rising by annual increments to £1,200 per annum.

AERADIO OPERATOR/MECHANICS must be able to pass a Morse sending and receiving test in plain language, code and cypher at speeds equivalent to 20 w.p.m. in plain language and possess a satisfactory knowledge of I.C.A.O. regulations and procedures. A minimum of 4 years' experience in the maintenance of low and medium powered radio transmitters, VHF D/F equipment, communication receivers and diesel electric plants up to 15 KVA is required. Possession of the appropriate City and Guilds certificates will be an advantage.

Commencing salary—£920 per annum rising by annual increments to £1,250 per annum.

AERADIO MECHANICS must have a minimum of 5 years' experience and be conversant with the installation and maintenance of low and medium powered MF, HF and VHF transmitters and associated line equipment for remote control operation; installation and maintenance of HF and VHF communication receivers including ability to carry out complete overhauls and re-alignment; installation and maintenance of HF and VHF D/F equipment.

Possession of City and Guilds certificates in Telecommunication Principles, Radio Communication Line Transmission and experience in the installation and maintenance of Radar equipment will be an advantage.

Commencing salary—£920 per annum, rising by annual increments to £1,250 per annum.

APPLICATION forms and further details from Secretary, Rhodesia House, 429 Strand, London, W.C.2. Closing date April 12. [3477

TUITION

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Department of Aeronautics

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APPLICATIONS are invited for a Studentship in Aeronautics, sponsored by the English Electric Co. for research in Aircraft Structures or Aerodynamics. Award tenable from October 1st, 1955; value £500. Applications by letter giving details of career should be sent to the Deputy Registrar, City & Guilds College, London, S.W.7., by May 1st, 1955. [3459

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For full details apply to: The Principal, AVIGATION LIMITED, 30 Central Chambers, Ealing B'way, London, W.5. Tel.: EALing 8949. [0248

FREE! Brochure giving details of courses in all branches aero eng. covering A.F.R.Ae.S., M.C.A., exam, etc. Also courses for all other branches of engineering.—Write: E.M.I. Institutes, Dept. F.26, London, W.4. (Associated with H.M.V.). [0964

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TUITION

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FOR details of these and other courses, apply to:—The Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

SKYWAYS, LTD., require experienced radio officers immediately. Reply giving full details to Personnel Manager, Skyways, Ltd., 7, Berkeley Street, W.1. [3468

SKYWAYS require engine and airframe fitters and a store keeper with A.R.B. experience at Bovingdon Airport. Write, call or phone Administrative Superintendent, Skyways, Ltd., Bovingdon Airport, Herts. [3939

SHORT BROTHERS AND HARLAND LIMITED

have vacancies in their Guided Weapons Department for:—

1. **A qualified stressman,** initially as a group leader but with an early prospect of becoming chief stressman. The appointment requires some experience in this field and is an excellent opening for the right young man.

2. **Stressmen,** for work on guided weapons and on special products. These departments are expanding and so present good prospects. They are housed in a completely new and modern factory.

3. **Aerodynamicists,** for control and stability problems. Qualifications: degree in engineering with aeronautical subjects or H.N.C. with relevant subjects and some experience in this field.

The amenities expected from a large and progressive company are available. Assistance with housing and removal expenses.

Applications giving all relevant details to:—

Staff Appointments Officer, P.O. Box 241, Belfast. Quoting Ref. No. S.A.37.

GLOSTER AIRCRAFT CO. LTD.

GLOUCESTER

HAVE VACANCIES ON SUPER-PRIORITY DESIGN AND DEVELOPMENT PROJECTS

FOR

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(SENIOR & JUNIOR)

Consideration will also be given to Draughtsmen with Mechanical, Structural or Electrical experience.

Also

STRESSMEN

(SENIOR & INTERMEDIATE)

for both strength and flutter calculations.

The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

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Have vacancies for

PLASTICS DEVELOPMENT ENGINEER
with experience of the practical application of reinforced plastics.

SENIOR STRESSMEN
H.N.C. minimum, preferably with experience of stressed skinned structures.

TEST RIG DRAUGHTSMEN
preferably with some experience.

WEIGHT ESTIMATOR
preferably with some experience.

Assistance with housing for senior personnel.

Cheap flying with firm's flying club.

Attractive staff pension scheme.

Applications (in confidence) should be addressed to:—

The Personnel Manager,
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Leading firm working in close conjunction with aircraft manufacturers and operators have immediate vacancy for a specialized

DESIGN ENGINEER

This appointment requires ability to design and supervise construction of cockpit sections of aircraft, including flying and engine controls, instrument panel lay-outs, etc.

House available to the successful candidate. Salary within the range of £700/£900, according to experience.

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Mechanical Design Engineers for initiating and directing original design work on light servo mechanisms, etc.

Also **Technical Assistants** with sound electronic background. These latter for employment on overcoming difficulties in setting up complex systems using modern electronic techniques.

Write fully, mentioning age, experience, when available, etc., to **Box No. AC. 05247, Samson Clarks, 57-61 Mortimer Street, London, W.1.**

ARMSTRONG SIDDELEY MOTORS LIMITED

REQUIRE EXPERIENCED DRAUGHTSMEN

for turbine aero engine design. Good salaries and prospects together with pension and superannuation schemes. Applications giving details of age, experience, etc., to **Reference CG/DSD1, Armstrong Siddeley Motors Ltd., Coventry.**

SITUATIONS VACANT

SKYWAYS LIMITED

REQUIRE the following categories of staff for projected new service:—

1. Aircrew

CAPTAINS and First Officers. The former to hold A.L.T.P. licences endorsed in Group 1 for Dakotas. First Officers must possess at least Senior Commercial licences with Dakota endorsements.

RADIO Officers with M.T.C.A. Flight Radio Operators licences.

2. Ground Staff

A.R.B. "A" and/or "C" Licensed Engineers required to work in France and England, Dakota and Pratt and Witney Twin Wasp endorsement essential.

MALE and female Traffic Clerks. Must be fully conversant with I.A.T.A. Airline Procedure and fluent in French.

RECEPTIONISTS/STEWARDESSES, aged 21 or over, fluent in French, smart appearance. Duties include reception, documentation and care of passengers on aircraft. Previous airline experience desirable.

GOOD rates of pay.

APPLY in writing to Personnel Manager, Skyways Ltd., 7 Berkeley Street, London, W.1. [3457

BLACKBURN & GENERAL AIRCRAFT LTD.

require

TECHNICAL ASSISTANTS

in

Senior and Intermediate grades of the Project Section of their

LONDON DESIGN OFFICE

THESE appointments will provide scope for men with ability and initiative on work concerned with Project Studies and Aerodynamic Design. Applicants must have H.N.C. minimum qualification, with a good aerodynamics background, and at least 3 years' aeronautical experience for the Senior grade.

APPLICATIONS (in strict confidence) giving full particulars of age, qualifications and experience to be addressed to:—

The Personnel Manager,
BLACKBURN & GENERAL AIRCRAFT LTD.,
Brough, East Yorks.
Mark envelopes ("London Design"). [3400

BLACKBURN & GENERAL AIRCRAFT LIMITED

require the following personnel for an expanding team engaged on an interesting programme of new work in their

LONDON DESIGN OFFICE

DESIGN DRAUGHTSMEN with aircraft experience.
INTERMEDIATE & JUNIOR DRAUGHTSMEN. Aircraft experience preferred but not essential.
SECTION LEADER STRESSMAN. With a Degree or H.N.C. and a minimum of four years experience as a Senior Stressman.
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Applications giving full particulars of age, qualifications and experience to be addressed to:—

THE MANAGER,
BLACKBURN & GENERAL AIRCRAFT, LTD.,
63 Old Brompton Road,
S. Kensington, London, S.W.7. [3420

SECTION LEADER DESIGN DRAUGHTSMAN IN WEST END (LONDON) DRAWING OFFICE

SENIOR staff status, pension fund and life insurance. Real opportunity for advancement to ambitious man with energy and drive. Minimum qualifications apprenticeship and H.N.C. or equivalent, with 5 years subsequent experience, aged 24/45. Preference given to men with knowledge of aircraft industry on light electrical, electronic or instrument work.

PLEASE write in detail, or send postcard for form of application, quoting Ref. 126, to: The Personnel Manager (Technical Employment), de Havilland Propellers, Ltd., Hatfield, Herts. [3428

ROCKET ENGINE DEVELOPMENT

MEN required for small group engaged on design and provision all kinds of rigs, used in development of liquid propulsion rocket engines. Should possess initiative as well as a Degree or Higher National Certificate in Mechanical Engineering and one at least should be capable of carrying out a design quickly and accurately with minimum of supervision. Initial salaries £500 to £800 commensurate with qualifications and experience. Good pension scheme provided and prospects generally excellent. Applications with full particulars of age, experience, etc., should be submitted to Reference RED 1, Box No. 2324. [3396

SKILLED airframe fitters required with Hermes experience. Training and other facilities provided to obtain "A" licence. Apply Personnel Manager, Skyways, Ltd., Stansted Airport, Essex. [3465

The London Design Office of

SHORT BROTHERS AND HARLAND LIMITED

has the following vacancies

1. **Senior Stressman** with experience of the different aspects of aircraft stressing. This is a Senior Staff position affording considerable scope and requires a willingness to accept responsibility. **Qualifications:** A degree in engineering or H.N.C. in relevant subjects.

2. **Stressmen** with some experience of aircraft stressing. **Qualifications:** As above.

3. **Structural Draughtsmen** for work on fuselage, wings, etc.

The prospects for all these classes are good, as is the pay, and the work is of great interest.

Applications, which will be treated strictly confidentially, giving full details, including salary expected, to:

THE MANAGER
London Design Office
SHORT BROTHERS & HARLAND LIMITED
208A, Regent Street, London, W.1,
quoting Ref. No. S.A. 36.

THE DE HAVILLAND ENGINE CO. LIMITED

invites applications from

TECHNICAL ASSISTANTS

for interesting employment on the following research work:—

(a) Basic design calculations relating to Aero Gas Turbine Engines.

(b) Performance estimating, test analysis and analysis of research data.

Experience in the design of Gas Turbine engines or in compressor or turbine design preferred but not essential.

Engineering degree or equivalent essential.

WRITE (quoting P.D.) giving age, qualifications and full details of industrial experience to:—

The Personnel Officer, The de Havilland Engine Company Ltd., Stag Lane, Edgware, Middlesex

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REQUIRED:

A PERSON OF INTEGRITY INITIATIVE AND RESOURCE

Fully qualified and capable of starting, controlling and running Design and Drawing Office in the Exeter area.

Position pensionable and offers great scope and possibilities to man 33-42, with comprehensive experience.

Salary by mutual arrangement.

All applications will be treated in strictest confidence.

Full particulars of experience and qualifications to : **Box No. 2479** *c/o Flight.*

JIG & TOOL DRAUGHTSMEN

Employment available to progressive type of man with initiative, on super-priority contracts; promotion secured by merit. Experience in aircraft tooling preferred, but sound training in Press Tool or mechanical engineering acceptable.

Pension and Life Insurance schemes open to successful applicants.

Written applications, with full details of qualifications and experience should be sent to:—

The Personnel Manager,
SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD.
BAGINTON, nr. COVENTRY

RESEARCH ASSISTANT

required for special work on
GAS TURBINE AERO ENGINES

Applicants should possess a Degree of at least a Higher National Certificate in Mechanical Engineering. Salary offered £600-£850 dependent on age and experience. As department is expanding prospects are excellent. Good superannuation and free insurance schemes.

Apply with full particulars of age, previous career, etc., to

Reference TPO 1,
Box No. 2220, c/o Flight.

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Applications are invited for a senior appointment on the production planning of the

BRITANNIA

Good salary and Pension Scheme.

Applications, giving full details of qualifications and experience, should be forwarded to the

Chief Personnel Officer,
The Bristol Aeroplane Company Limited,
Filton House, Bristol.

SITUATIONS VACANT

SENIOR DESIGN DRAUGHTSMAN

A SENIOR design draughtsman is required by the assistant chief engineer for aero engine and installation work in the new drawing office situated in the West End of London. Preference will be given to applicant possessing H.N.C. or equivalent. Aero engine experience desirable but not essential. Good salary, pension and life assurance scheme.—Full particulars, quoting E.D.30, to the Personnel Manager, The Bristol Aeroplane Co., Ltd., Engine Division, Filton House, Bristol. [3300

CHIEF ESTIMATOR

A LEADING aircraft company in the Greater London Area invites applications for the position of chief estimator. Applicants should be under 45 with a wide general experience of aircraft production, preferably including an apprenticeship in the aircraft industry, and have been employed for the past five years in a senior estimating capacity.

APPLICATIONS to include full details of career and present position to Box 2062. [3464

AERODYNAMICISTS AND ENGINEERS

VACANCIES occur in the aerodynamics department of a rapidly expanding aircraft instrument firm engaged on the design and development of Autopilots for aircraft and helicopters. Substantial salaries are offered to men with experience of aircraft flight trials and stability and control analysis. Please forward full details, with salary required (which will be treated in strict confidence) to Box 2538. [3475

DE HAVILLAND AIRCRAFT COMPANY, LIMITED, Airspeed Division, Christchurch, nr. Bournemouth, Hants.

HAVE vacancies in their Structural Testing Laboratory for assistants with experience in strength testing of aircraft components, and ability to design and draw test rigs.

H.N.C. (Mech.) or its equivalent is an asset but is not regarded as essential.

PLEASE write giving full details of salary required to the Personnel Office of the above address. [3423

REQUIRED 'A' and 'C' licensed ground engineers for work on light aircraft. Wiltshire School of Flying, Thruxton Aerodrome, Andover, Hants. [3473

THE BRISTOL AEROPLANE COMPANY LIMITED have vacancies in the Service Department for the following positions:

1. Airframe Service Engineer: Applicants to have served a mechanical engineering apprenticeship, have five years' practical experience of modern aircraft and be in possession of O.N.C., preference being given to those in possession of ground engineer's licence.

2. Electrical Service Engineer: Applicants to have served an electrical engineering apprenticeship, good experience of electrical installations in modern aircraft and be educated to O.N.C. standard.

BOTH posts will be directly associated with the servicing of Britannia aircraft; successful applicants being required to give technical advice and assistance to the aircraft operators, the greater part of their employment being spent outside the U.K. Good salaries and working conditions, together with pension, life assurance and welfare schemes.

APPLICATIONS in writing giving full particulars, and quoting AIR. 6, should be addressed to:—The Personnel Manager, The Bristol Aeroplane Company, Limited, Aircraft Division, Filton House, Bristol. [3382

AIRWORK GENERAL TRADING CO., LTD., require the following personnel for employment at London Airport.

LICENSED engineers, with A and C Licences on Dakota and Viking Aircraft, Hercules and Pratt & Whitney 1830.90.D. engines, engine fitters, airframe riggers, aircraft electricians and radio mechanics.

APPLICATIONS for employment should be made in the first instance either in person or by writing to Works Manager, Airwork General Trading Co., Ltd., Blackbushe Airport, Camberley, Surrey. [3445

AIRFRAME/ENGINE fitter. Licences not essential but experience on light aircraft an advantage. Single accommodation available. Write in first instance to F. Pinchin, Luton Flying Club, Luton. [3458

"ON the ground floor." Senior, intermediate and junior draughtsmen wanted for interesting airframe programme. Expanding organization. London D.O. Reply fully Box 2504. [3446

WANTED. Fully experienced instrument mechanic for servicing air survey cameras. Good prospects.—Apply Hunting Aerosurveys, Ltd., 6 Elstree Way, Borehamwood, Hertfordshire, giving qualifications and salary required. [3454

CAMBRIAN AIR SERVICES have a vacancy for station engineer, Staverton. "A. and C." licence covering all light aircraft essential and Rapides an advantage. Salary according to experience and qualifications.

Apply: Chief Engineer at Rhoose Airport, S. Wales. Telephone: Barry 2100. [3482

LIAISON Engineer (aircraft) required for expanding department dealing with the insulation of jet pipes. Applicants should be preferably of H.N.C. standard with D.O. experience. The post is of an administrative nature and commercial experience is desirable. Write stating qualifications and experience to Chief Designer, Delaney Gallay Ltd., Vulcan Works, Edgware Road, Cricklewood, N.W.2. [3470

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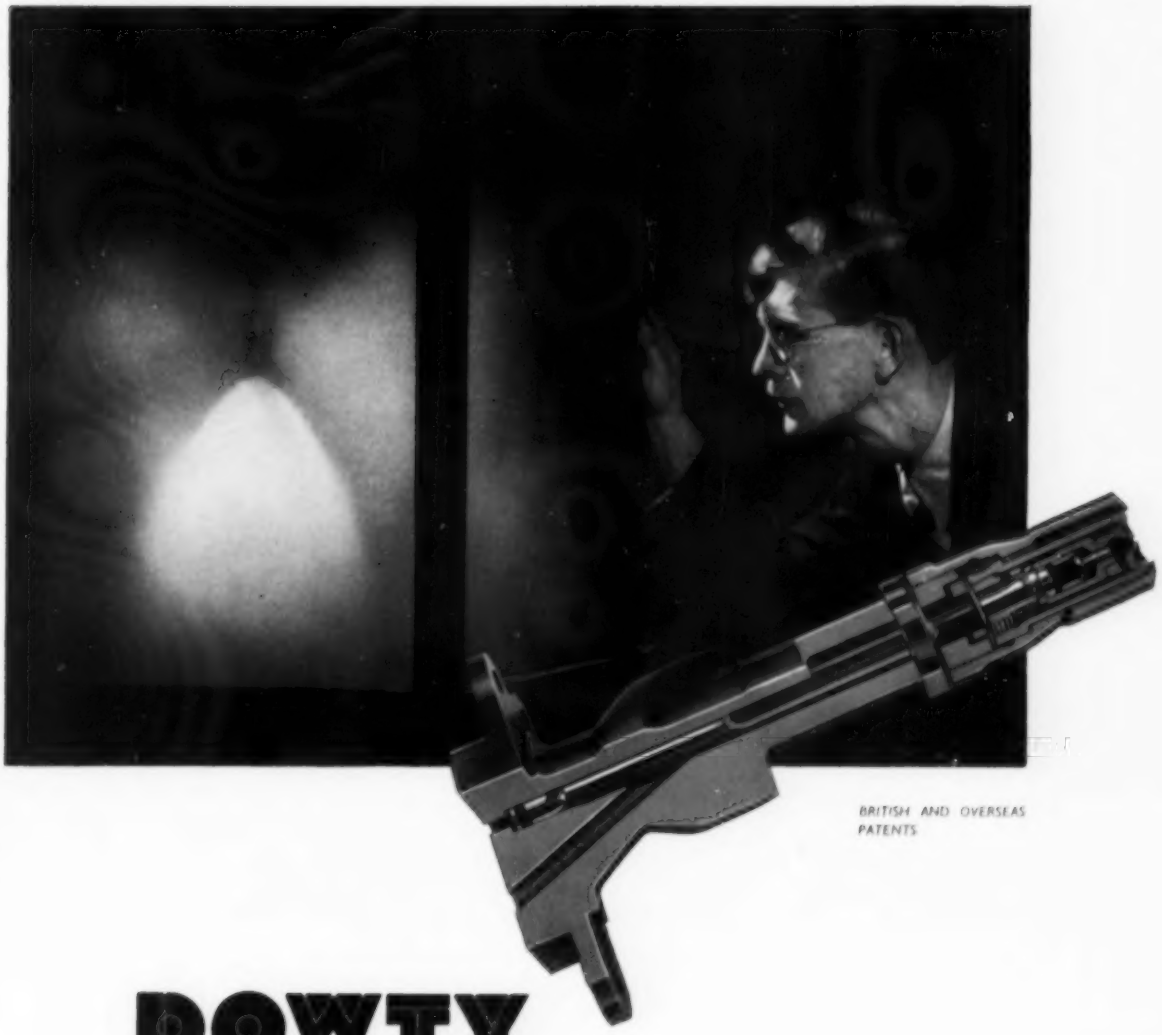

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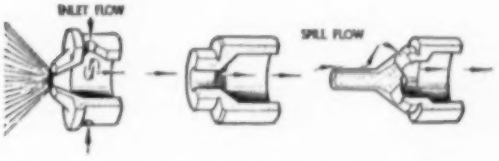

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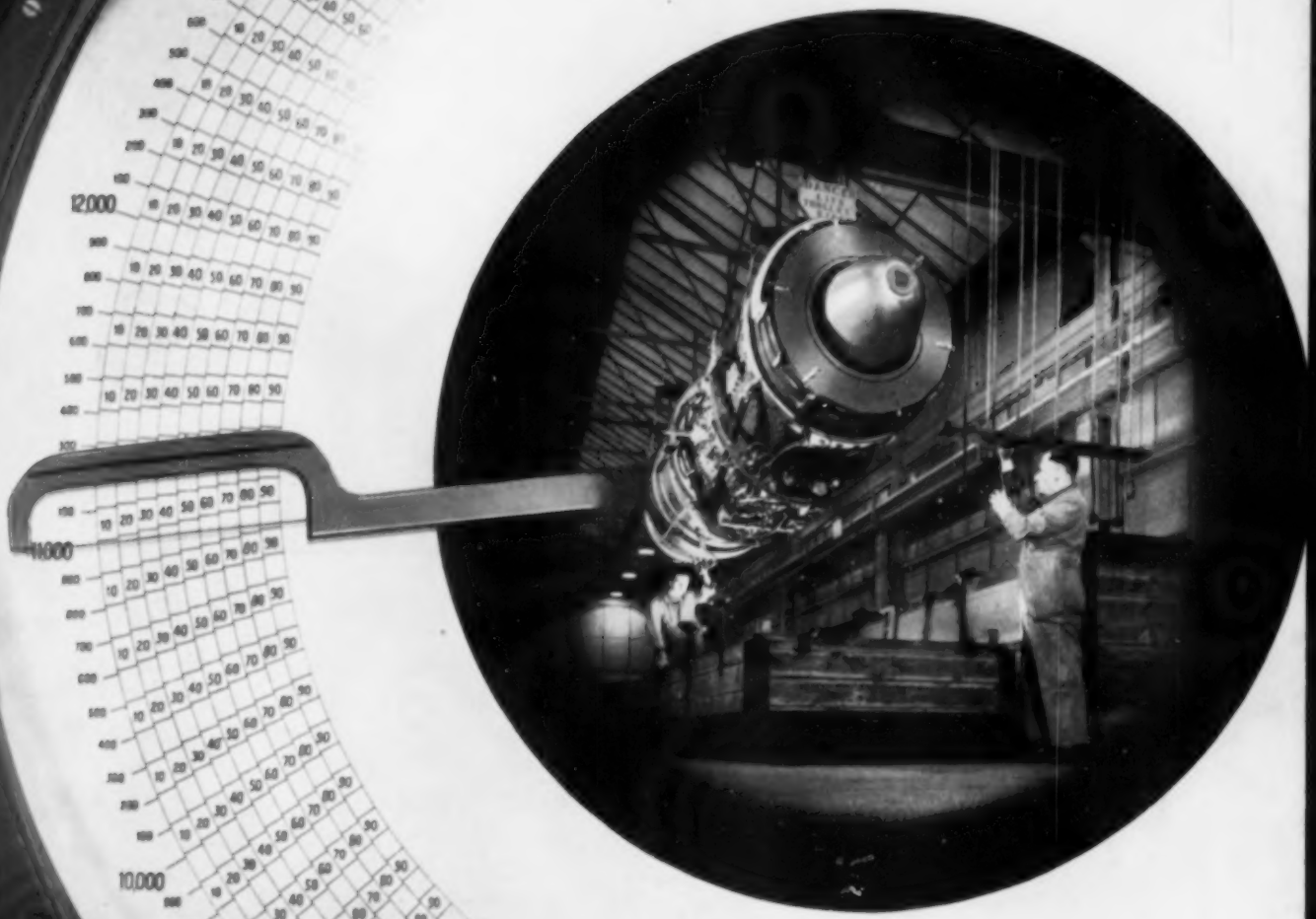

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